The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XVIII. No. 4
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APRIL 1921

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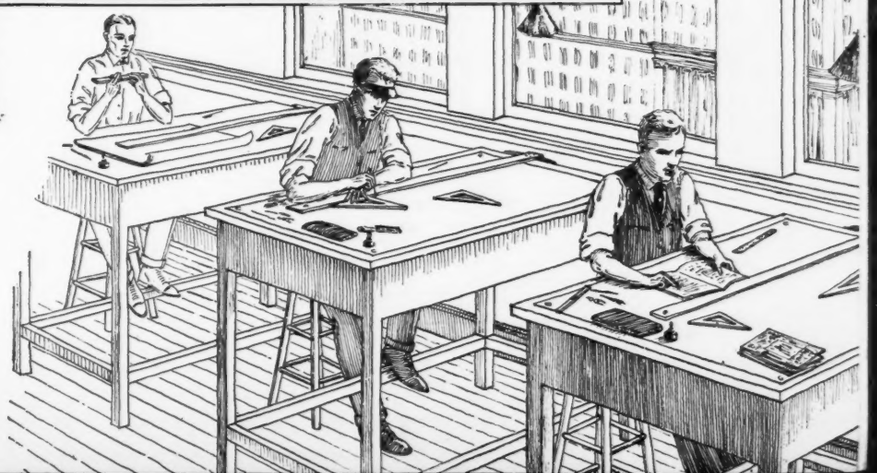
New York Office, 1123 Broadway

SAVE

COAL

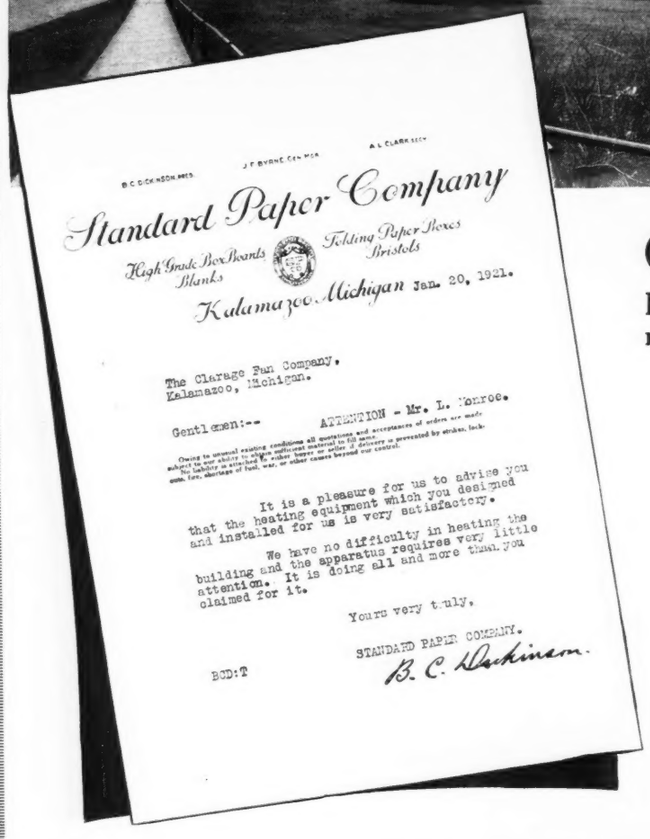
(See page 5)



CLARAGE
KALAMAZOO

ONE COST— for Both Heating and Ventilation

A Clarage System was installed over a year ago in this new Paper Box Factory of the Standard Paper Co., Kalamazoo, Michigan. The interior view gives a glimpse of the piping and fresh air outlets. Clarage Engineers designed the entire heating and ventilating system. G. G. Worden of Kalamazoo was the Architect for the building.



B. C. DICKINSON, PRES. J. F. BYRNE, CEN. MGR. A. L. CLARK, SEC'Y.

Standard Paper Company

High Grade Box Boards Blanks — Folding Paper Boxes Bristols

Kalamazoo, Michigan Jan. 20, 1921.

The Clarage Fan Company,
Kalamazoo, Michigan.

Gentlemen:-- ATTENTION - Mr. L. Monroe.

Owing to unusual existing conditions all quotations and acceptances of orders are made subject to our ability to secure sufficient material to fill same.
No liability is attached to either buyer or seller if delivery is prevented by strikes, lock-outs, fire, shortage of fuel, war, or other causes beyond our control.

It is a pleasure for us to advise you that the heating equipment which you designed and installed for us is very satisfactory.

We have no difficulty in heating the building and the apparatus requires very little attention. It is doing all and more than you claimed for it.

Yours very truly,

STANDARD PAPER COMPANY.

B. C. Dickinson.

BCD:T

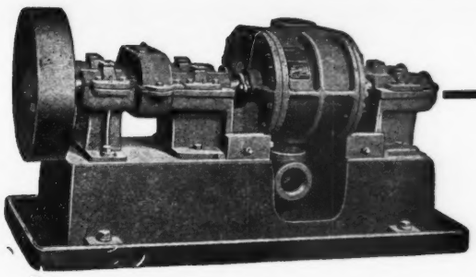
ONE first cost covers both heating and ventilation, if you install a Clarage Fan Blower System. And this cost is not excessive.

With a Clarage System, your workmen have fresh, pure air from out-of-doors the year around—warmed in winter, cool in summer. This good, wholesome air in your factory will keep your workers wide-awake and on their toes every minute. Further—the equipment located in one place, offers economy of space, reduces the cost of steam connections, and affords control by one man.

Why not have our engineers cooperate with you on your heating problems? Write, wire or phone us today.

Clarage Fan Company
404-10 Porter Street
Kalamazoo, Michigan

Manufacturers of Fans, Blowers, Heaters, Engines, etc.



Connersville Vacuum Pumps have been installed in the—

State Capitol Bldg., Little Rock, Ark.
Medinah Temple, Chicago, Ill.
Severin Hotel, Indianapolis Ind.
Bureau of Standards Bldg., Washington, D. C.
Vanderbilt University, Nashville, Tenn.
Commerce Bldg., St. Paul, Minn.
Shubert Theatre, Denver, Col.
Lamb Apartments, Houston, Texas.

Satisfaction in Service

Is there anything more gratifying than to buy a machine, install it and then have it perform its operation without causing you worry or trouble?

Connersville Valveless Vacuum Pumps are giving that kind of satisfactory service in many heating plants. You will find them in public buildings, office buildings, theatres, homes, factories—in fact, in all types of buildings.

The Connersville Blower Company

Connersville Indiana U.S.A.

Chicago, 1431 Monadnock Block New York, 114 Liberty Street

Marsh Reflex Junior Thermostatic Traps

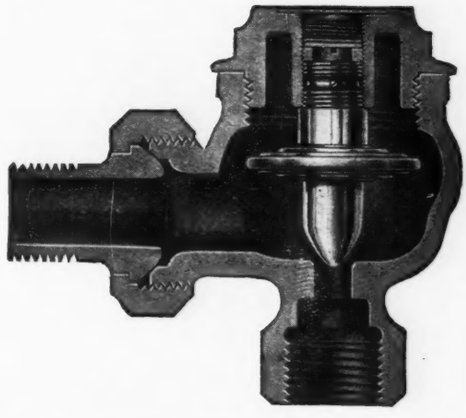
For Radiators and Coils of "Low Pressure," "Vapor" and "Vacuum Heating Systems"

FREELY DISCHARGES AIR AND WATER WITHOUT LOSS OF STEAM

THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor or vacum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, to **free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

The Marsh Reflux Junior Thermostatic Trap is recommended for small radiators and coils. This Trap for the small and the Original Reflux for the large units will make an ideal job. Especially adaptable for two pipe gravity work and vapor systems.

May be furnished either sealed adjustment (as illustrated) or with outside adjustment.



Write for literature fully describing this Trap

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

Founded 1865

Manufacturers of Gauges for all Pressures **Automatic Air Valves and Steam Specialties**

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
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JOHN SIMMONS CO

110 Center Street, New York

IRON AND STEEL PIPE—FITTINGS—VALVES

RAILWAY
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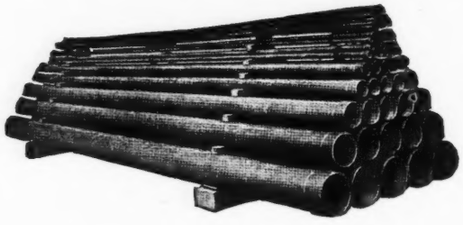
and
FACTORY SUPPLIES



STEAM SPECIALTIES
FIRE PROTECTION
EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

PIPE COILS and BENDS — PLUMBING SUPPLIES

Special Literature Sent on Request

Duplex Sleeve Expansion Joint

Air-Cooled, Guided

ADSCO

An absolutely new expansion joint for high pressures and superheat, designed to prolong the life of the packing. This feature will appeal strongly to all steam engineers.

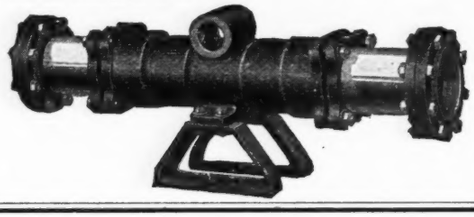
The constant circulation of air between inner and outer sleeve keeps the temperature of the outer sleeve lower than the inner. The packing of the slip is against the outer sleeve. Thus the life of the packing is greatly prolonged.

The air-cooled slip is perfectly guided in its traverse, insuring an absolutely straight and true thrust of the slip into the body of the expansion joint. Can be furnished with either flanged or beveled ends; with or without anchors.

Write for Bulletin No. 72-H describing the new expansion joint in detail.

All Materials for Underground Steam Main Construction

This Company has specialized on expansion joints for many years; In fact, designed and built the first expansion joint forty years ago. These joints are of heavy, rugged construction. They have deep stuffing boxes and packing glands. All slips (above 10 in.) are made from heavy cast bronze—smaller sizes from seamless, brass tubing, iron pipe size.



"Adsco" Expansion Joints are built
Single or double
With or without service openings,
With or without anchorage saddles
For high and low pressures and for superheated steam.

Let us quote on your requirements for any material used in connection with Underground Steam Main Construction, or for the distribution of steam for any purpose.

AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS
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First Nat'l Bank Bldg. Chicago
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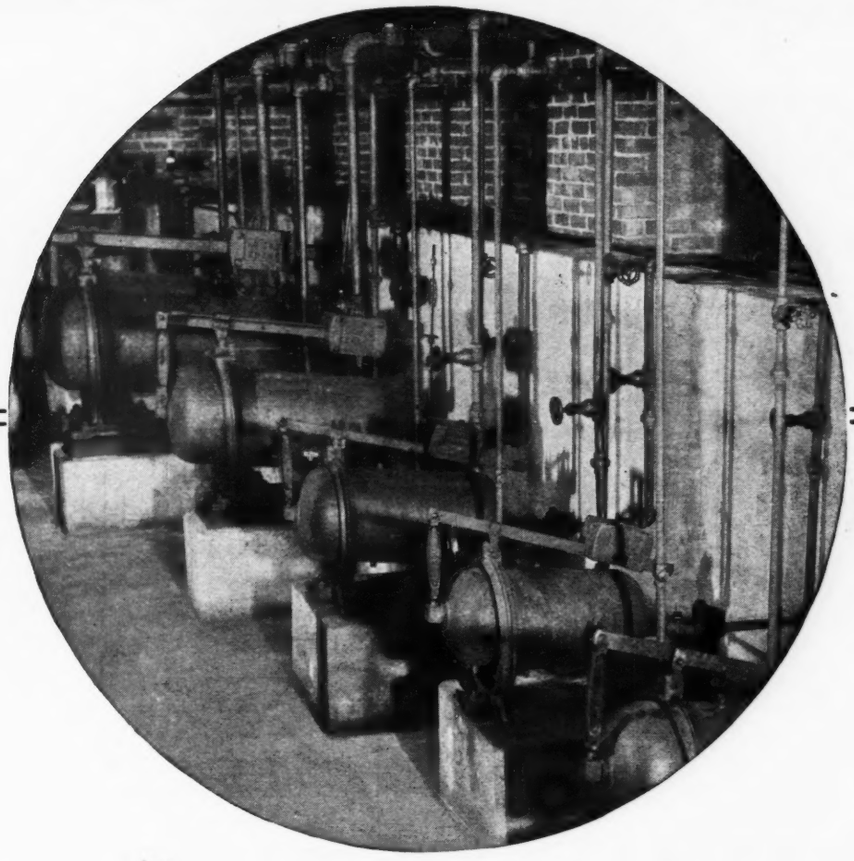
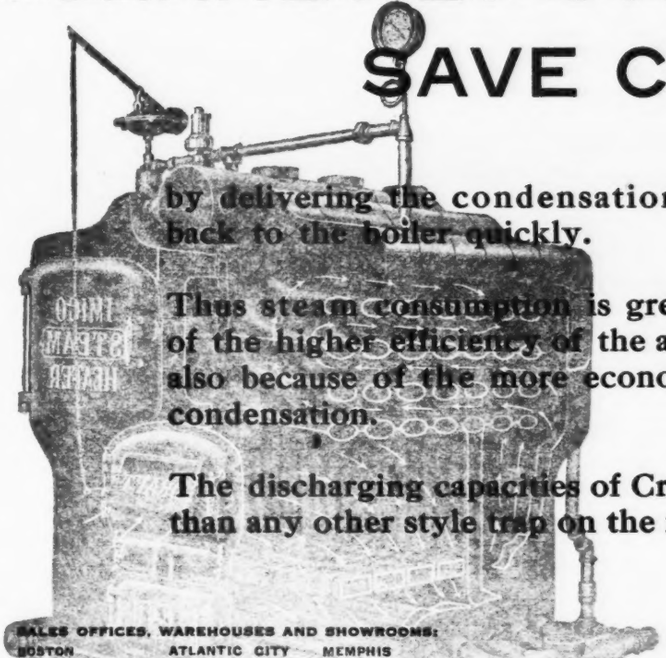


CRANETILT STEAM TRAPS SAVE COAL



by delivering the condensation in the heating lines back to the boiler quickly.

Thus steam consumption is greatly reduced, because of the higher efficiency of the apparatus so drained and also because of the more economical handling of the condensation.

The discharging capacities of Cranetilt Traps are greater than any other style trap on the market.

SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON, SPRINGFIELD, HARTFORD, BRIDGEPORT, ROCHESTER, NEW YORK, HARLEM, ALBANY, BROOKLYN, PHILADELPHIA, READING, ATLANTIC CITY, NEWARK, CAMDEN, BALTIMORE, WASHINGTON, SYRACUSE, BUFFALO, SAVANNAH, ATLANTA, KNOXVILLE, BIRMINGHAM, MEMPHIS, LITTLE ROCK, MUSKOGEE, TULSA, OKLAHOMA CITY, WICHITA, ST. LOUIS, KANSAS CITY, TERRE HAUTE, CINCINNATI, INDIANAPOLIS, DETROIT, CHICAGO, ROCKFORD, OSHKOSH, GRAND RAPIDS, DAVENPORT, DES MOINES, OMAHA, SIOUX CITY, ST. PAUL, MINNEAPOLIS, WINONA, DULUTH, FARGO, WATERTOWN, ABERDEEN, GREAT FALLS, BILLINGS, SPOKANE, SEATTLE, TACOMA, PORTLAND, POCATELLO, SALT LAKE CITY, OGDEN, SACRAMENTO, OAKLAND, SAN FRANCISCO, LOS ANGELES

WORKS: CHICAGO AND BRIDGEPORT

FOUNDED BY R. T. CRANE, 1855

CRANE CO.

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CHICAGO

CRANE LIMITED — MONTREAL, TORONTO, VANCOUVER, WINNIPEG, CALGARY, REGINA, HALIFAX, OTTAWA, QUEBEC, HAMILTON, LONDON, ENG., BIRMINGHAM, ENG., MANCHESTER, ENG., SYDNEY, N. S. W.

at the sign of good heating
INTERNATIONAL
BOILERS & FURNACES

BOILER EFFICIENCY

is dependent upon the design of the boiler as a unit. Don't make the mistake of picking out one feature of design because it is strongly emphasized and basing your decision upon that particular feature alone. All factors must be so proportioned and related to each other as to produce the maximum evaporation from each pound of fuel burned.

ECONOMY BOILERS

are carefully balanced and the efficiency of each individual size is a known quantity. It will pay you to investigate the **Economy** before deciding your next installation.

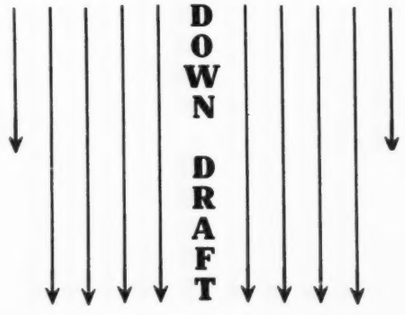
Send for catalog, just off the press, H-1296.

INTERNATIONAL HEATER COMPANY
UTICA, N. Y.

Branch Offices and Warehouses at New York Chicago Nashua, N. H.

IMICO
Heating Boilers

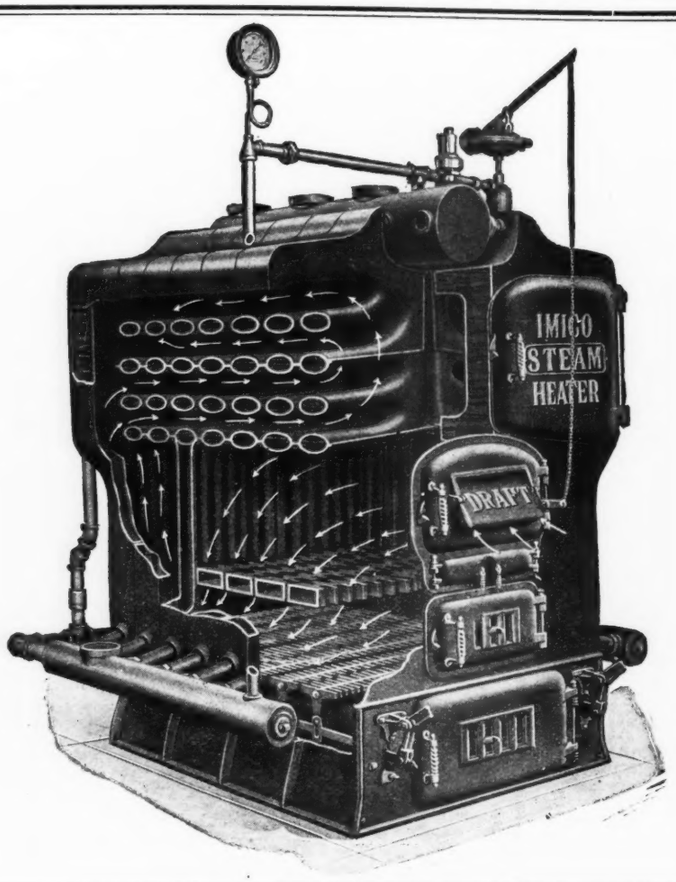
Smokeless



For Water or Steam

Our Catalogue describing our complete line of Heating Apparatus sent on request

Illinois Malleable Iron Co.
Chicago



Priming—

—a very common condition but not easily detected by the unskilled man found in charge of a greater number of plants. The Kelly Controller stops priming before a skilled fireman could even discover it.

Surging—

When grease or other foreign matter in the water causes a foaming or surging in the steam line, unfailing boiler control, such as the Kelly Controller assures, marks the difference between boiler efficiency and inefficiency.

Syphoning—

When syphoned water trickles back to a red hot boiler, taxing the cast sections with the enormous force of superheated steam, the effect—often disastrous and always expensive—pays many times over for the device that would have prevented it.

These Three Dangers Threaten Every Heating Boiler

Few low pressure steam heating systems warrant employing a skilled engineer to constantly watch the operation of heating boilers.

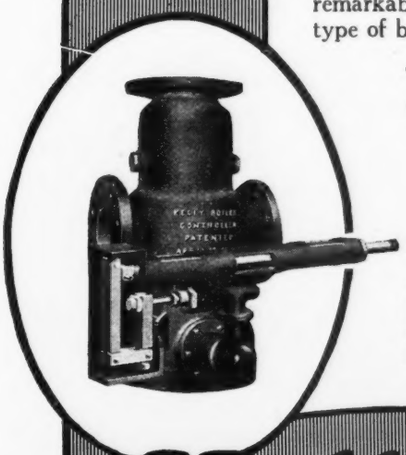
Yet the annual cost of property damage resulting from boiler explosions and cracked sections prove that there are many times when an expert in charge would have proven a real asset.

This fact led to the development of a device which would guard the operation of a heating boiler, just as the skilled engineer watches each developing trouble and blocks it before it reaches the danger stage.

In the Kelly Controller such a device has been produced. The Kelly Controller meets every impending danger with a responsiveness that cannot be equalled by the most skilled engineer; yet it enables any plant to enjoy all the advantages of the closely supervised boiler installation without the expense of a trained fireman.

Although faithful and effective in every function, the Kelly Controller is remarkably simple, comparatively inexpensive, and easily installed on every type of boiler old or new. It merely takes the place of the steam header.

The new extensive catalog explains in detail how the Kelly overcomes priming, surging, syphoning, etc. Have you your copy?



The Kelly Controller has successfully undergone the rigid tests necessary to secure that stamp of proven merit—the Fairbanks Company famous "O K"

MANUFACTURED BY

THE KELLY CONTROLLER CO.

175 W. Jackson Blvd., Chicago

SOLD BY

THE FAIRBANKS COMPANY

New York and 23 Principal Cities

Kelly Controller

"The Boiler Master"

A Saving of 1-3 of Initial

How Re-Circulated, Ozonized Air

TO obtain good ventilation the air in a room must be *changed completely several times per hour.* It is self-evident that considerable heat would be saved if the air could be recirculated within the building.

This would be a general solution of the problem were it not for the fact that *re-circulation* brings in bad air troubles. The air becomes "stale" and absorbs many bad odors, thus causing an unhealthy and uncomfortable condition. But this problem is easily solved by a system that rids this *re-circulated* air of all odors by supplying fresh *ozone,* thereby revitalizing the air.

How to Figure the Saving of Fuel by Re-circulating the Air

This is accomplished by reducing the amount of outside air to be introduced into the building to approximately 15% of the total air that is circulated through the rooms. We therefore save the heat necessary to raise the other 85% of the air used from the outside temperature to the final temperature at which it is introduced into the room.

Let us take a typical building heated entirely by means of hot air introduced by fans and heated by tempering and reheating coils. A final temperature of approximately 135 degrees is necessary at the fan outlets to produce a temperature of 70 degrees *in the rooms.*

A 25-unit Equipment Ozone Pure Airifier
Capable of Ozonizing 25,000 cu. ft. of Air per Minute

The difference in fuel con- —*outside,* zero-air to —*re-circulated,* 65- same 135

If the outside temperature is zero and *all* the air is taken from the outside, this air will have to be raised 135 degrees in temperature. If, however, the air of the rooms is *re-circulated* and only 15% of the outside air introduced, then 85% of the air will have to be raised from only 65 degrees (the temperature of the air at leaving the rooms) to 135 degrees, or but 70 degrees. Therefore, if 85% of the air is raised 70 degrees and 15% is raised

And, also saves of your

135 degrees, the *average* raise is only *80* degrees, or a saving of 45%. It is easy to figure the *saving in* fuel that will be brought about by this saving of air heating.

In what is termed the "split system," in which enough direct radiation is installed in the rooms to take care of the wall and glass losses, the air is delivered to the rooms at about 80 degrees. As the *re-circulated* air in this case would only have to be raised ten degrees the saving as far as the air change loss is concerned is 75%.

The fuel required for the direct radiation is constant, but as the indirect radiation averages about 65% of the total equivalent direct radiation installed, the overall saving in this case at 0 (zero) degrees outside temperature would be approximately 49%.

Cost of Heating Plant!!!

in Ventilating Systems is Saving Fuel

While some engineers think that where Ozone *Pure-Air*ifiers are installed a fuel saving of 50 per cent is possible, we are content to produce a saving of 20 to 25 per cent. One engineer, who is making a test of ozone, says that if it will save but 10 per cent of his fuel bill he will recommend installing one in every school in his city.

Current Consumed

The current consumed by the apparatus is ex-

sumption between raising 135 degrees, and degree air to the degrees—

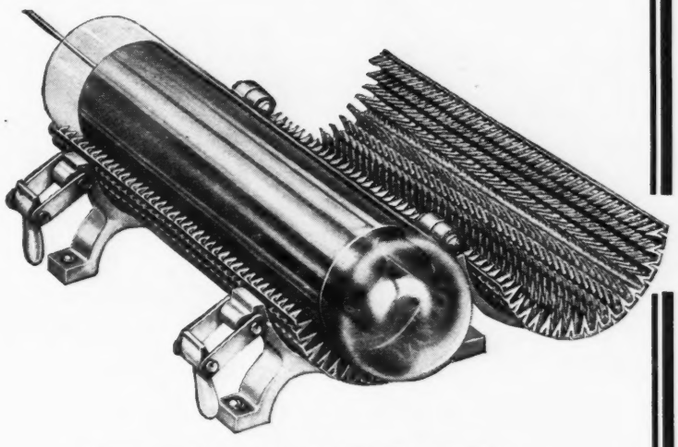
tremely small, being only about 120 watts maximum for a 25,000 cu. ft. machine when operating on alternating current. Based on a current cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

The success of any *ozone* apparatus depends on the use of a static discharge instead of an electric spark. If a spark is used, considerable nitrous oxide is formed, which is a very destructive agent.

25 to 50 per cent fuel bills—

The only way to avoid the production of nitrous oxide is to keep the electrodes in direct contact with the dielectric. This necessitates the use of pointed electrodes, producing a continual faint glow of current. Inasmuch as both of these features are covered by basic patents *owned by us* it is apparent that the *"Ozone Pure Air*ifier" is the only completely successful *ozone* generating apparatus for air purification that can be offered to the public.

The Ozone *Pure Air*ifier shown in Fig. 1, for installation in the air ducts supplying the building, solves the problem of economically heating and ventilating large buildings.



One complete Unit of 1,000 Points Each
Opened to Show How Easily the Cylinders May be Cleaned, if Necessary

In using the Ozone *Pure Air*ifier where air washers are used, the amount of *Ozone* injected into the air will also purify the recirculating water of the air washer, making it unnecessary to install a separate Ozone *Pure Air*ifier for the water system.

The Ozone *Pure-Air*ifier does not (nor is it intended that it should)supplant ventilation, but, only supplements it. Nor is it designed to take the place of air washers, but can be used either with or without. We recommend air washing with proper humidity control for cooling purposes.

A recognized Heating and Ventilating Engineer of Kansas City says:

"Your Ozone *Pure Air*ifier not only improves the condition of the air, but in addition is a large fuel saver. In the fifteen years that we have been in the heating and ventilating engineering field, we do not recollect of any device that we see greater prospects for than the *Ozone* apparatus."

The Ozone *Pure Air*ifier is made in any size desired to meet exact requirements. Knowing the amount of air that it is necessary to circulate per minute, in any building in question, any engineer can immediately figure the number of cylinders required when specifying the Ozone *Pure Air*ifier.

The Ozone *Pure Air*ifier is an apparatus produced by an organization which has been in the air purification business for *over twelve years,* having manufactured Ozone *Pure Air*ifiers for all classes of buildings and to have met with unqualified success almost every possible "bad air" condition.

OZONE PURE AIRIFIER CO., 1403 W. Jackson Blvd.
CHICAGO, ILL.

KENNEDY

RENEWABLE-DISC RADIATOR VALVES

Unfailing reliability of service, reasonable prices and the guarantee of satisfaction that a long established company is able to furnish, make Kennedy Radiator Valves the best buy for steam and hot water service on the market.

We can honestly recommend them for use anywhere, and invite a close scrutiny of those points of design and construction that set them apart as decidedly superior. They come in every desirable type—straightaway, angle, offset, corner, etc.

Other Kennedy Valves for handling water, steam, oil, acids, gas, alkalis, etc., in more than 500 distinct types and sizes are at your service. Our catalogue illustrates and lists them all. Send for a copy.

THE KENNEDY VALVE MFG. CO. ELMIRA, N.Y.

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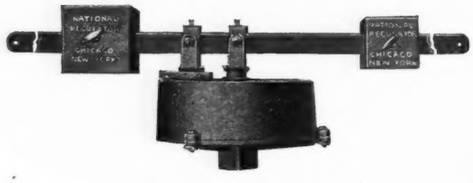
74

HOT WATER LOW PRESSURE

2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

One for Every Duty & Duty for Every One

handling boilers to see that they are equipped with sensitive, powerful and durable regulators. Metaphram means the best metallic Regulator made.

TRADE METAPHRAM MARK REG U S PAT OFFICE

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

VAPOR

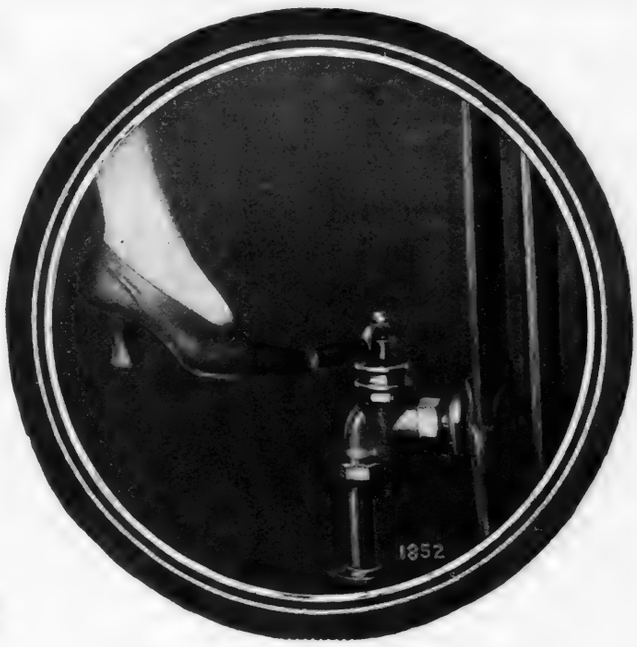
A-JACKS for HIGH PRESSURE

A Quarter Turn of the Handle Opens or Closes the

GORTON
QUICK-OPENING
VALVE

It moves with a touch of the foot or hand—quarter turn does the trick. Prevents opening a window to cool a room quickly (with resultant waste of steam and coal) for it is easier to operate the radiator with Gorton valve than it is to open windows.

There's a real saving for both your client and yourself in our suggestion that you write for full particulars.



No stooping. The slightest touch of the foot operates the valve.

Here are the Details of this Remarkable Valve

A. The valve with a packing lock—Acknowledged the best type of valve packing.

B. A ground ball shoulder fitting on a ground seat, Steam and water tight, and stays tight.

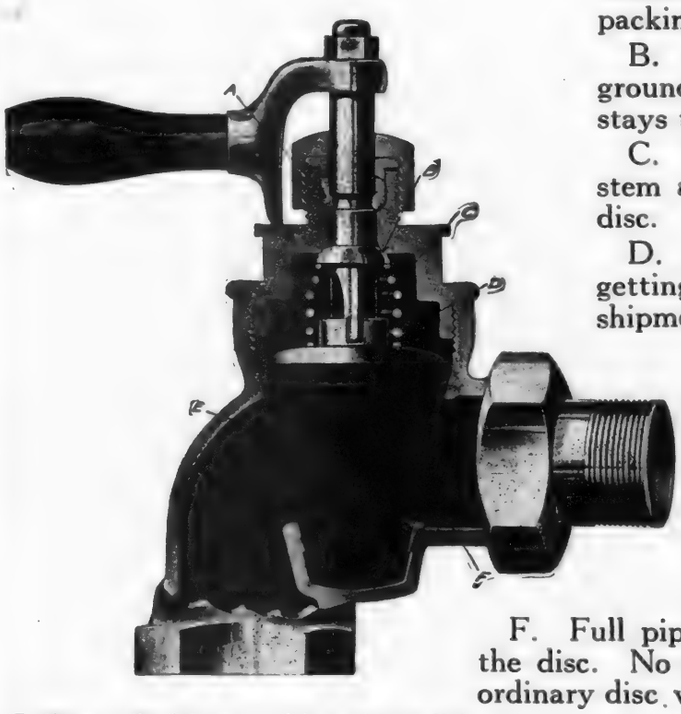
C. Loose joint connection between valve stem and disc—insuring perfect seating of disc.

D. Bronze spring prevents grit or dirt getting between disc and valve seat during shipment.

E. Mineral composition disc, no metal, sulphur nor rubber. Disc and seat both machine ground to a perfect taper surface, giving perfect seat.

A combination proof against rusting, wedging, cutting, abrasion and leaking.

F. Full pipe size unobstructed passage through the disc. No obstruction to passage of steam as in ordinary disc valve.



Radiator or Straightway—with or without Union

Equip your Radiators with Gorton Valves and save money on the coal pile

GORTON & LIDGERWOOD CO., 100 Liberty St., New York, N. Y.

See Sweet's Architectural Catalog, page 1757, for Specifications—Write for Catalogs.

Moline Heat

EVERYWHERE

MOLINE ILLINOIS

C. W. Buckingham, Architect, Jacksonville, Ill. Jacksonville Plumbing & Heating Co., Heating Contractors, NORBURY SANITARIUM, Jacksonville, Ill. Jacksonville, Ill.

Kemp Hotel, Wichita Falls, Texas

Noiseless—Even—Perfect—Low Pressure Steam Circulation

For buildings of every size and character, in any locality.

Without the use of automatic air valves or traps on radiators. No vacuum pumps.

This scientific system of Steam Circulation necessarily saves maintenance cost and fuel. Complete Construction Details furnished for each installation, thereby insuring perfect results.

Relieves the Contractor of needless and expensive responsibilities, making his work more profitable.

Moline Heat Cooperative Sales Service is endorsed by leading Contractors everywhere.

Send for complete literature today.

Y. M. C. A., Racine, Wis.

Columbus Athletic Club, Columbus, Ohio

Ira M. Cobe Residence, Northport, Maine

MOLINE HEAT

MOLINE ILLINOIS

Some territory still open for salesmen. If you are a salesman, see advertisement on page 84.

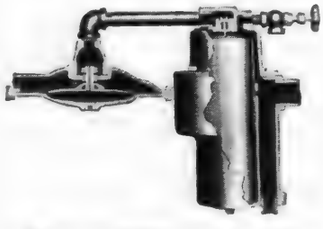
Moline Heat,
Moline, Ill. Department F

Please send me complete literature describing Moline Heat and your cooperative sales service.

Name.....

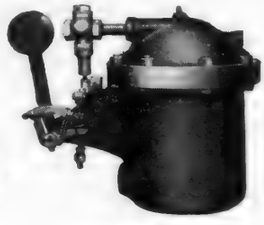
Address.....

Rock Island Plow Co., Rock Island, Ill.

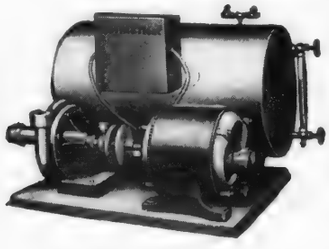


Moline Air Relief Valve and Vacuum Valve

Moline Restricted Supply Valve



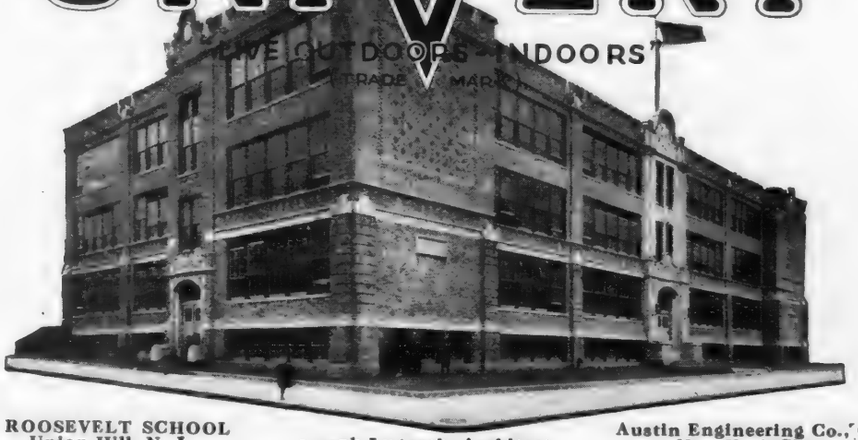
Condensation Return Trap



Condensation Return Pump

UNIVENT

"LIVE OUT DOORS—INDOORS"
TRADE MARK



ROOSEVELT SCHOOL
Union Hill, N. J.
Equipped with 40 Univents

Joseph Lugosch, Architect
Union Hill, N. J.
J. B. Holbrook, Engineer, New York City

Austin Engineering Co., Cont.
New York City

Utica Trust Deposit Bank, Utica, N. Y.

Detroit Edison Bldg., Detroit, Mich.

These are some of the buildings being equipped with the Univent, now recognized as the greatest progressive step in ventilating buildings, that has taken place in a decade.

The Univent is the scientific development and perfection of the Monarch System—the original "Unit Ventilator."

Saves in building construction. Eliminates unsanitary heat flues and ducts, the "bugabear" of all previous ventilating systems. Provides individual control of the ventilation in each room or section of the building.

Simple—easy to install.

Enthusiastically endorsed by leading architects, engineers and contractors.

Approved by National Board of Fire Underwriters.

It is important that you know all about the Univent System. Send for Engineers' and Architects' Special Edition Catalog today.

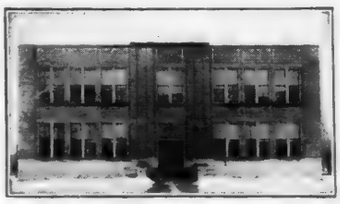
Some territory open for Sales Representatives. If you are a salesman, see advertisement on page 84.

Moline Heat,
Moline, Ill. Department F
Please send me the Engineers' and Architects' Edition of your Univent Catalog.
I am interested in Heating and Ventilating.

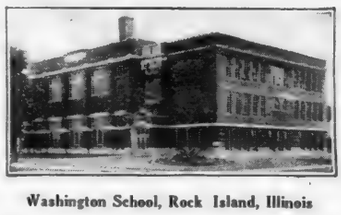
Name.....

Address.....

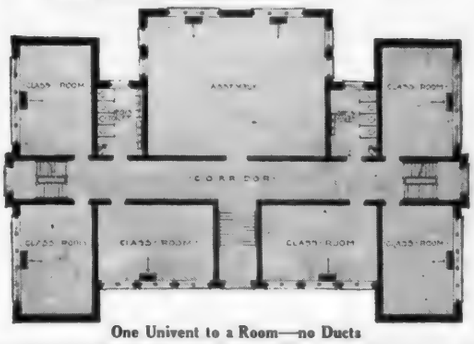
Grade School, Creston, Iowa



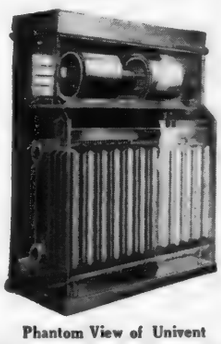
Grade School, Rexburg, Idaho



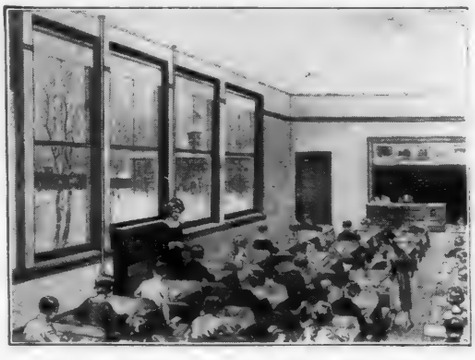
Washington School, Rock Island, Illinois



One Univent to a Room—no Ducts

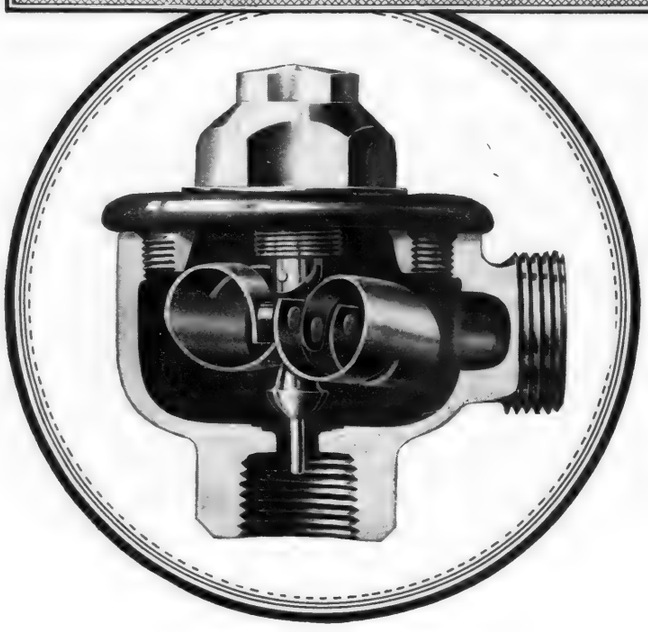


Phantom View of Univent



Classroom Showing Univent Installation—Note Size

PERMANENCY



Trane Thermetal Traps

Established

LA CROSSE TRANE WISCONSIN

1883

It is not only first tests that count. It is permanency—the certainty that they will continue to operate dependably and efficiently that distinguishes Trane Thermetal Radiator Traps.

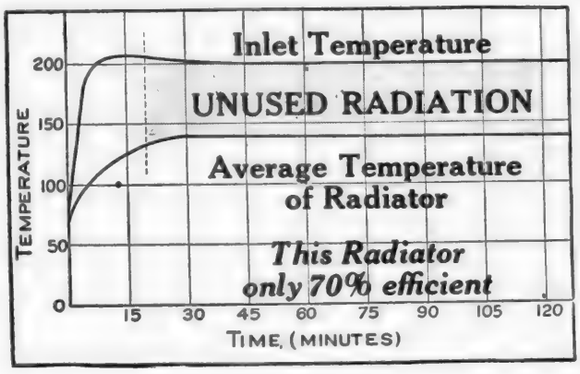
Permanent all-metal construction, the distinguishing feature of Trane Thermetal Traps, insures that their proven operation will continue for years and years.

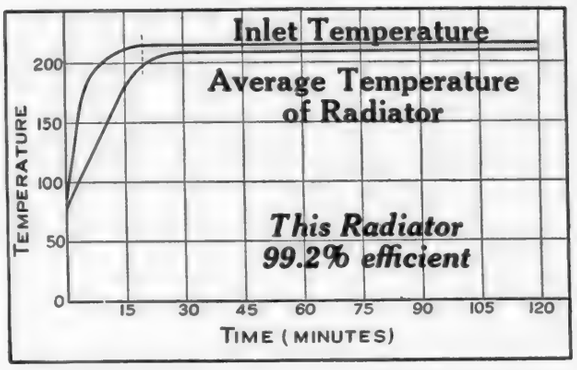
Engineers and architects who have investigated the record of both the metal and the traps have unhesitatingly adopted them. There is no higher grade product for high grade buildings.

Write for Bulletin No. 6

The Trane Company, 206 Cameron Ave., La Crosse, Wis.

Chicago	Washington, D. C.	New York	Boston	Philadelphia	Salt Lake City
175 W. Jackson Blvd.	510 Bond Bldg.	11 John St.	110 State St.	20 S. 7th St.	407 Dooly Bldg.





Making Radiation Usable

All who specify and install radiation are agreed upon one point: radiators cannot do their work when they are choked up with air and water.

The curves above are from actual laboratory tests and the same radiator, fitted with two kinds of radiator traps—one of which was the Dunham Radiator Trap—the trap that has been making radiators practically 100% hot since 1903.

You know which trap you would prefer. So would the man who pays the bill for the radiation which he rightfully expects will keep every room warm.

Making radiation usable is as commendable as the conservation of coal.

Dunham Specialties

Packless Radiator Valves
Radiator Traps
Drip Traps
Blast Traps
Air Line Valves
Vacuum Pump Governors
Reducing Pressure Valves
Oil Separators
Suction Strainers
Air Vents
Return Traps
Check Dampers
Damper Regulators

Send for the entire Dunham story.
You will find it interesting.

The DUNHAM
REG. TRADE-MARK
HEATING SERVICE

C. A. DUNHAM COMPANY
230 East Ohio Street CHICAGO

Factories: Marshalltown, Iowa Toronto, Canada

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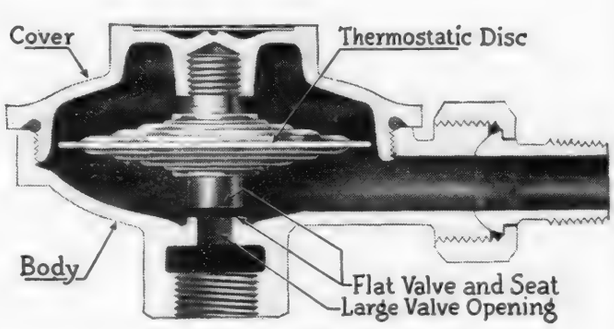
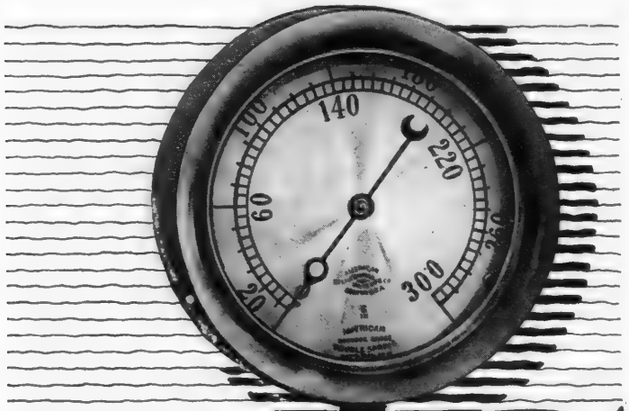


Cross-section of No. 2 Trap



Accuracy!

When we first started to make gauges, away back in 1851, we selected the word **Accuracy** as our manufacturing slogan. Unwavering adherence to that policy is responsible today for the universal reputation for reliable performance that attaches to American Gauges.

When you install an American Gauge you know that it will prove dependable because you know that it is conscientiously as well as scientifically built.

AMERICAN GAUGES

are equipped with a spring that is solid drawn from the finest grade of bronze, specially selected and rigorously tested. Curved, tested and adjusted by experienced gauge makers, it responds with **infallible accuracy** to every pressure variation.

Each dial is individually **hand-calibrated** and therefore absolutely accurate.

The segment is of special cast bronze and has an extra wide face to reduce wear to a minimum. Both segment and pinion rest is of phosphor bronze bushings, further reducing wear and insuring the maintenance of accuracy.

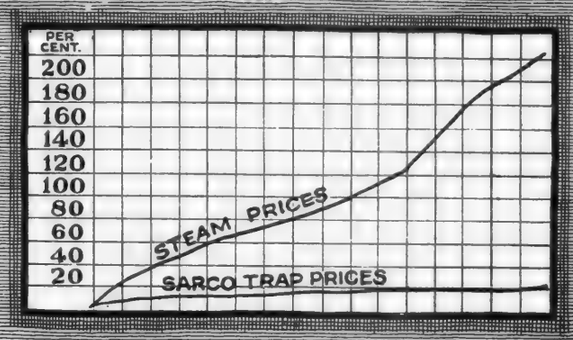
At every point, ACCURACY. And along with Accuracy, durability that assures long service.

Our Catalog No. 70 gives other interesting facts that you ought to know. Write for it today.

AMERICAN STEAM GAUGE & VALVE MFG. CO.

Boston, Mass.

Atlanta **New York**
Chicago **Los Angeles** **Pittsburgh**



Stop Waste at the Coal Pile

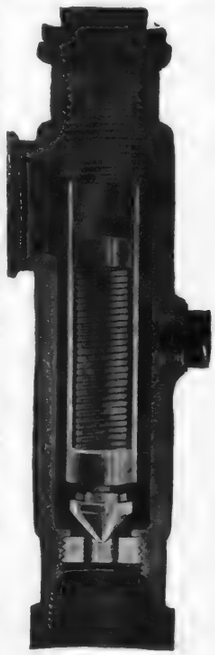
Steam costs 200% more than it did five years ago, but Steam Trap SARCO prices have not increased more than 20%. The relation between cost and saving in dollars and cents is so much greater now than before the war that you cannot afford to leave lines untrapped or badly trapped.

Coal today is so high—and frequently so hard to get—that every shovelful counts. It will pay, and pay big, to check up on your steam line and see where coal is being wasted and money being lost through insufficient trapping.

You can put in *three* Steam Trap Sarcos—*stop the loss at three different points*—for the cost of just *one* old-style trap.

The Sarco closes promptly and positively prevents all loss of live steam. And it returns condensate to the hot well while still hot.

Sarco is so small and compact that it takes little more room than an ordinary elbow—can be installed at steam-wasting points where the bulkiness of old-style traps would make them out of the question. No platform, pit or supports needed.



We are ready to let Sarco demonstrate its superiority and economy right in your own plant by sending you one on 30 days' trial without a cent in advance. If for any reason whatever you aren't satisfied with its performance, if it doesn't prove that it quickly pays for itself through the coal it saves, then you can return it and it won't cost you one cent.

Made in sizes ⅜ in. to 3 in., and for any given pressure up to 200 lbs.

Booklet No. P-12 and full particulars about our free trial offer on request.

SARCO CO., INC.

231 Broadway

NEW YORK CITY

Buffalo Cleveland Philadelphia
Chicago Detroit

Steam trap SARCO

Webster
ESTABLISHED
-1888-

The Ideal Heating System

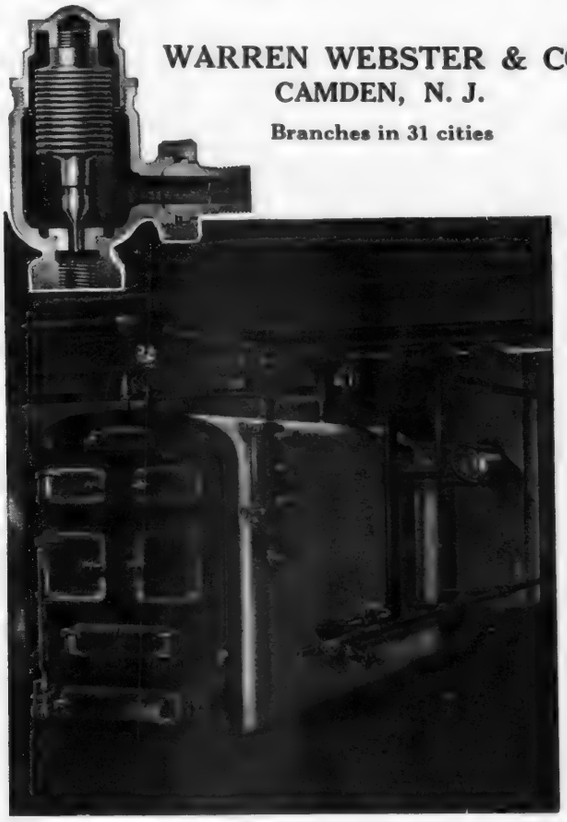
for the city or suburban residence, office building, institution, school and other types of structures that do not cover a large area, should be one from which utmost comfort can be secured at minimum of maintenance.

The Webster Modulation System of Steam Heating

is designed to meet this condition of service. The temperature of each room can be accurately adjusted to suit occupants without disturbing the temperature condition in other rooms. Condensation and entrained air are effectively removed from the radiators without noise.

A typical boiler room showing the application of the Webster Damper Regulator and Webster Modulation Vent Trap is illustrated below. The draft is controlled effectively to maintain the necessary steam pressure. Entrained air is vented to atmosphere and the return of water is automatically accomplished.

There is a Webster Heating Engineer located near you, and who will gladly supply necessary heating data and assist in laying out your next job. Call him in!



Typical Boiler Connections and Arrangement of Webster Appliances for the Webster Modulation System

WARREN WEBSTER & CO.
CAMDEN, N. J.

Branches in 31 cities 110

New Time Punch Revolutionizes Recording Thermometers

Now you can keep a day and night tab on the man responsible for maintaining the correct temperature in your heat-treat process or elsewhere, as well as on the hour-to-hour and minute-to-minute variations in the temperature.

The Columbia Recording Thermometer is now equipped with a brand new feature—a TIME PUNCH attachment which makes it a two-in-one instrument that does double duty. It not only records every fluctuation in the temperature, but also shows whether the man in charge has been *watching* these fluctuations as he should.

Every time the operator inspects the temperature record, he also presses the Time Punch—and the hour and minute is instantly and automatically recorded on the reord dial. This puts the operator on his toes in two ways—first prompts him to make regular inspections—the time clock puts a black mark against him if he doesn't; and second, the fact that the exact time of each inspection shows on the dial along with the exact temperature at that minute, leaves him with no alibi or excuse for failing to correct any undue fluctuation in the temperature.

The conscientious operator will take pride in having the proof of his dependability put on record. While the man who is inclined to be careless or forgetful will immediately brace up when he knows there is a constant check on him. The result in either case is bound to be a more uniform temperature—less spoilage and damage, greater efficiency, lower operating costs.

Columbia Recording Thermometers with the new Time Punch cost no more than for an ordinary recorder alone.

Simple, direct and positive in their action.

Every instrument rigidly inspected. Any temperature up to 1000° F. can be recorded accurately.

Columbia Recording Gauges and Tachometers are also equipped with this new Time Punch without extra charge.

Send for Columbia Recording Thermometer Catalog H-14.

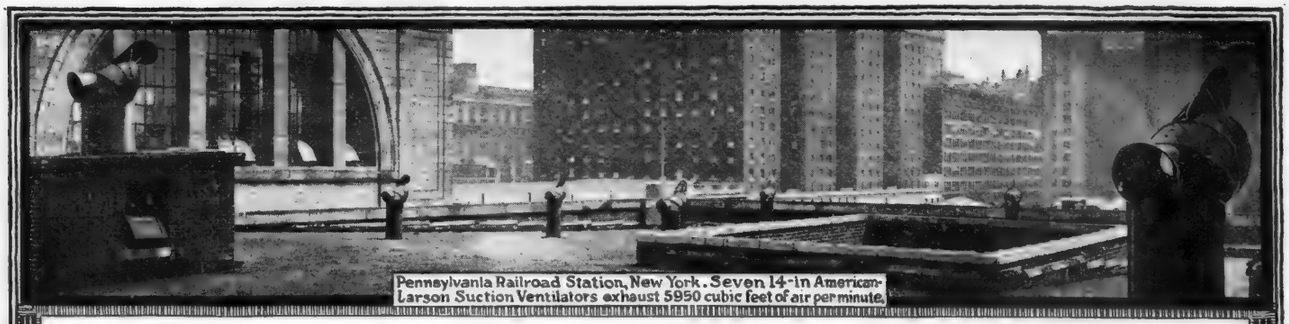
THE Schaeffer & Budenberg MFG. CO.

Makers of Instruments for the Promotion of Efficiency in Power Plant and Manufacturing Departments

Berry and South Fifth Streets
BROOKLYN, N. Y,

Chicago Detroit Los Angeles Philadelphia Pittsburgh San Francisco Washington

Columbia Recording Thermometers



Pennsylvania Railroad Station, New York. Seven 14-in American-Larson Suction Ventilators exhaust 5950 cubic feet of air per minute.

Maximum Ventilating Effectiveness—Minimum Air-Line Obstruction

This much-sought combination you can invariably effect with the American-Larson Suction Ventilator. It is the *only* suction ventilator utilizing the siphon principle in a logical way. The ejector tube in the rear, being kept in strict alignment with the direction of the wind, catches the full force of the breeze. Augmented by the air-current at the discharge opening, this force acts as a strong siphon, drawing the impure air in an easy upward course to the outside air.

Because of its improved construction, a given size of the American-Larson has *double* the exhaust capacity of any other suction ventilator. This means that only *half* the number of ventilators is required to exhaust a given amount of air, thus halving the purchase price, the installation and transportation charges. It means *half* the number of holes in the roof; it means reducing the obstruction to the air line to a *minimum*. As a matter of fact, the American-Larson Suction Ventilators can usually be so placed as to preserve the architectural contour of the building in its entirety.

An installation of the American-Larson Suction Ventilator is an abiding satisfaction to your client and yourself.

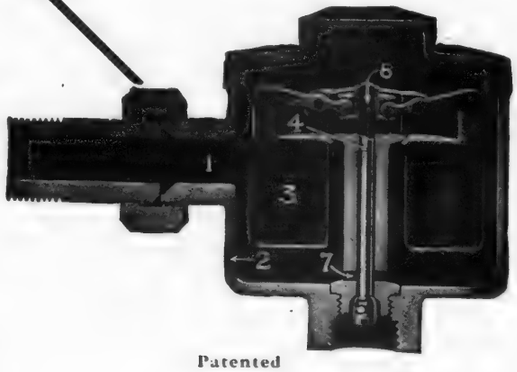
May we not send you our catalog which shows construction details in full and contains a specification form?

Kindly address Dept. H.

Martin Bldg. **The American Ventilating Co.** Pittsburgh, Pa.

AMERICAN LARSON SUCTION VENTILATORS

A Steam Trap that Automatically Eliminates Air and Water Condensation Without Allowing Escape of Steam



Patented

THE McDonald Under-Seat Valve is the only valve of its kind on the market. The principle of operation is positive and noiseless. It gives perfect service on any radiator on a two-pipe heating system and under any ordinary pressure up to ten pounds. Handles and discharges a much larger quantity of water than any other trap or valve of equal size. Self-cleaning. Carries away all scale. Entire inside instantly removable by loosening cap. Saves every ounce of steam. Its economical features are greatly appreciated by the building owner.

Leading architects, heating engineers and contractors are specifying and installing large numbers of the McDonald Under-Seat Valve, because its superior features bave been proven in service.

Write for detailed information

The McDonald Under Seat Valve Co.

602 Swetland Building CLEVELAND, OHIO

ALLEN AIR-TURBINE VENTILATOR

Standard of Ventilating Efficiency

Patented

The Allen **Ventilator is an *air-driven* rotating suction turbine. It creates a *mechanically forced action*, precisely the same as expensive steam or electrically driven systems.**

Therefore its air displacement capacity is positive, dependable, *measurable and guaranteed.*

But its low initial and installation cost is also the final cost. It *eliminates all operating expense*, care, expert attention and up-keep.

ASK A USER - HE KNOWS

Allen **Air-Turbine Ventilators are unaffected by snow, ice, sleet or rain. *They are positively leak-proof*, and the powerful, continuous upward suction flow of air make *down drafts impossible.***

Wherever ventilation is desired—in factories, foundries, stores, schools, hotels, churches, theatres, residences, kitchens, bakeries, tanneries, barns, stables, garages, chimneys, air shafts, or wherever air circulation is required, Allen Air-Turbines *have proven the best, cheapest and most efficient* ventilating system known.

Many of America's largest industrial concerns have adopted and endorse the Allen Air-Turbine Ventilators.

Write for Detailed Literature

ALLEN AIR-TURBINE VENTILATOR CO.
DETROIT **Eighth and Porter Sts.** **MICHIGAN**

CARRIES OFF
GASES
MOISTURE
STEAM
SMOKE
VAPOR
FOUL AIR
ODORS
HEAT
FUMES
DUST
DAMPNESS

Sylphon

For Constant Temperatures

Metal Heart of Every Sylphon Specialty

Making Sylphon Service Mean More to You

You know that real temperature control depends not only upon the perfection of the controlling devices but reaches back to the organization that builds them. We have the largest plant in the world devoted to the manufacture of thermostatic devices, and are now building a commensurate field sales and service force.

An important feature of our present expansion plan is the presence of a direct Fulton representative and a stock of Sylphon heating specialties, Sylphon Packless Valves and Sylphon Temperature Regulators in every large center. In other words, we are not going to sell you merely a commodity, but service, with real engineers to counsel with you. This means genuine service plus quick deliveries and personal engineering attention.

With the new additions to our line, our direct field organization will supplement the work being done by the American Radiator Company, Johnson Service Company, and Warren Webster & Company.

These new lines are completely covered by Bulletin WT-101 which we will forward, or better our representative will call, upon request.

THE FULTON COMPANY

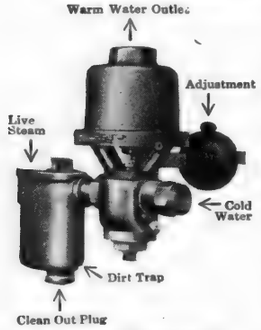
KNOXVILLE, TENNESSEE **U. S. A.**

Representatives in all the larger centers

BRANCHES: 1476 Broadway, New York **7 E. Van Buren, Chicago** **1261 Book Bldg., Detroit, Mich.**

TEMPERATURE CONTROLLING APPARATUS

Thermostatic Water Heater



The Powers Thermostatic Water Heater

A safe, sure and accurate method of heating water with high pressure steam. Thermostatically controlled. Mixes live steam and cold water, delivering water of desired temperature at outlet.

Adapted to workmen's wash sinks, shower baths, etc., in factories, mines and other industrial plants, and to a great variety of purposes where a supply of warm or hot water of a specified temperature is desired at irregular intervals.

Absolutely safe against scalding.

Ask for Bulletin 137.

High Pressure Steam Trap

This is a small, compact and extremely efficient trap suited to apparatus using high pressure steam for its heating properties.

Absolutely positive in its operation, discharging freely a large volume of water, but closing tight against steam. Constructed on the vapor disc principle.

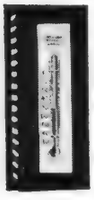
Suitable for use on Sterilizers, Dryers, Steam Kettles, Steam Tables, etc.

Will automatically pass water of condensation but close against steam, insuring greatest economy in steam consumption.

Ask for Bulletins 115 and 122.

Powers High Pressure Steam Trap

Control of Temperature in Living Rooms


The Powers Thermostat

Industrial establishments are fast awakening to the fact that automatic control of temperature in offices and shops is a necessity if production is to be maintained at the maximum. Overheated rooms mean a slowing up of workers, a menace to health and a waste of fuel and labor. Rooms insufficiently heated mean less work accomplished because of clumsiness of cold fingers; more accidents, sub-standard results and wasted materials.

The Powers System of Temperature Regulation is noted for its great accuracy and durability. May be installed in old or new buildings, for all, or any portion of the rooms.

The thermostat illustrated is typical of the Powers System. Wherever you see one, you may be assured that the system *works*.

Another feature of the Powers System is the All-Metal Radiator Valve—famous as the "Last-forever" Valve.

Ask for Bulletin 150 for further particulars.

The Powers "Last-forever" Valve

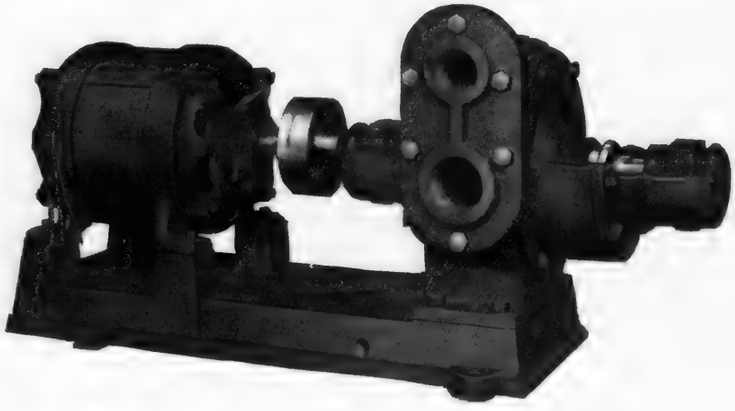
(1550)

The Powers Regulator Co.
Specialists in Automatic Heat Control

954 Architects Bldg. New York — 2718 Greenview Avenue Chicago
565 Boston Wharf Building, Boston
The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

"ALLENCLIF" CENTRIFUGAL PUMPS

FOR CONTINUOUSLY SATISFACTORY SERVICE



SIMPLE IN DESIGN
EASILY MAINTAINED
CHEAPLY OPERATED

INTERCHANGEABLE, BRONZE BUSHED, RING OILING BEARINGS

CAN BE DISMANTLED AND REASSEMBLED WITHOUT DISCONNECTING PIPES OR MOVING MOTOR

THEY ARE EFFICIENT, RELIABLE PUMPS FOR CIRCULATING, PRESSURE BOOSTING, OR GENERAL SERVICE

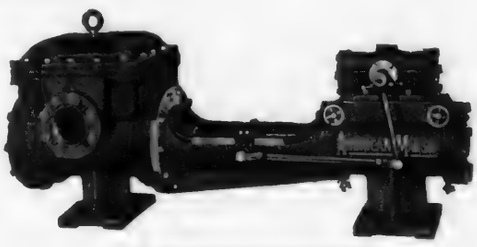
THE ALLENCLIF ENGINEERING COMPANY

638 E. LIVINGSTON AVE. — WRITE FOR BULLETIN NO. 1 — COLUMBUS, OHIO

American-Marsh Pumps

for Heating Systems

For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable.



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

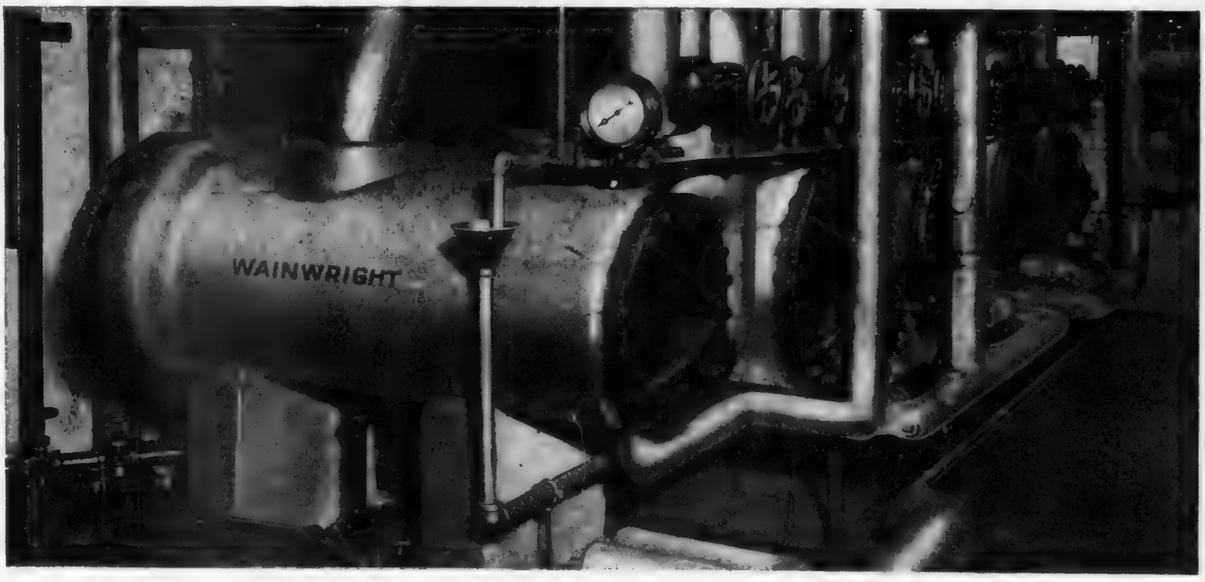
Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

Ask for Bulletins Nos. 24 and 27

AMERICAN STEAM PUMP CO.
Battle Creek, Mich.

Our slogan: Simplex not Duplex. "To be simple is to be great"

"Wainwright" Service Heaters



ALBERGER PUMP & CONDENSER COMPANY
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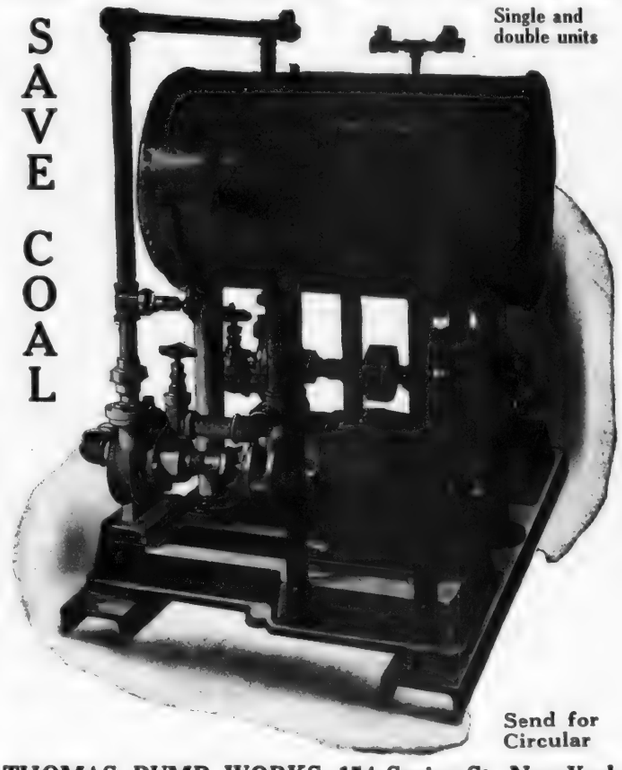

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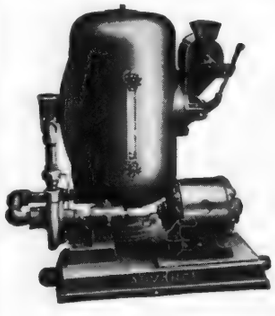

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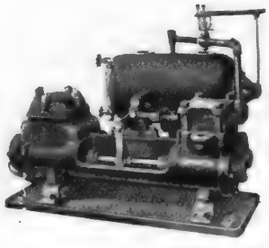

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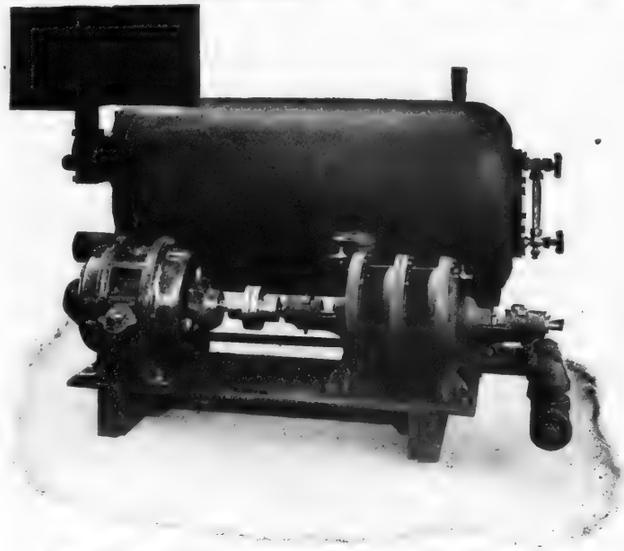

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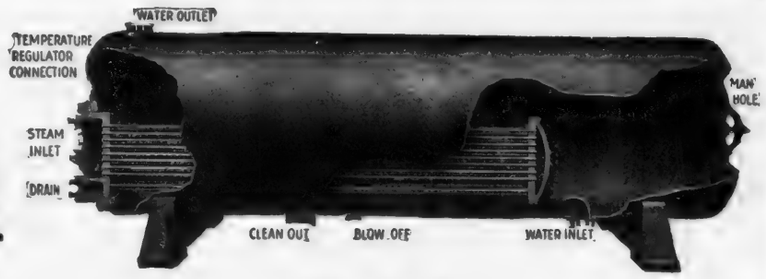

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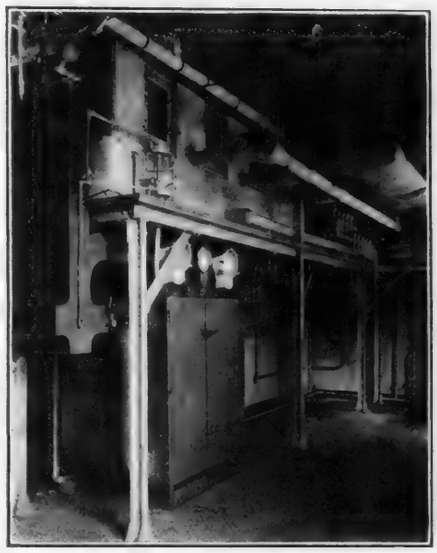

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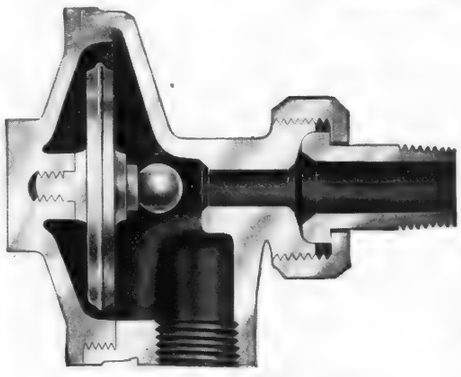

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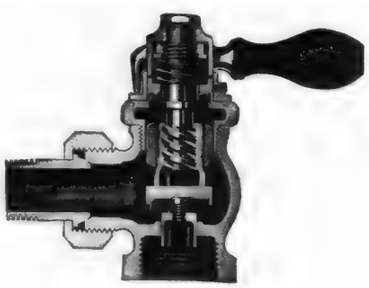

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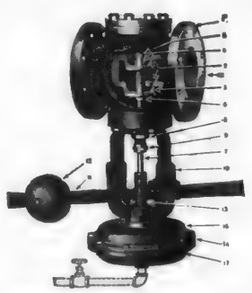

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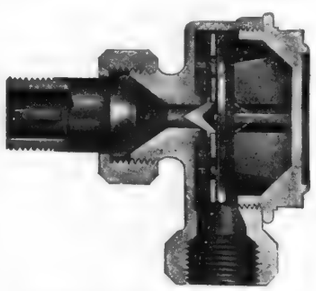

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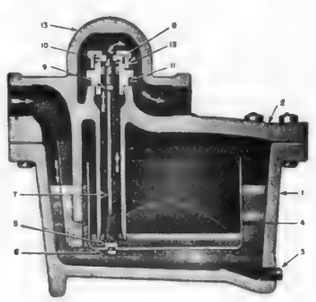

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The Heating and Ventilating Magazine

VOL. XVIII. NO. 4

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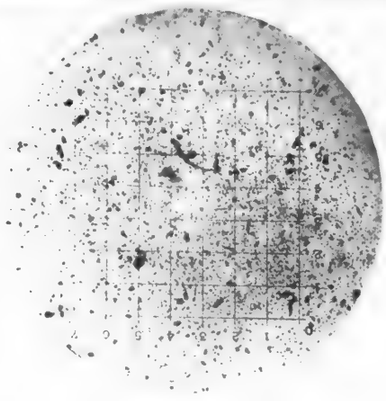

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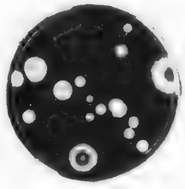

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A MONTHLY JOURNAL OF ENGINEERING PROGRESS

APRIL, 1921

CO-OPERATIVE OFFICE BUILDING IN MINNEAPOLIS, MINN.

CO-OPERATIVE OFFICES FOR PROFESSIONAL WORK

As Worked Out by a Group of Architects and Engineers in Minneapolis, Minnesota

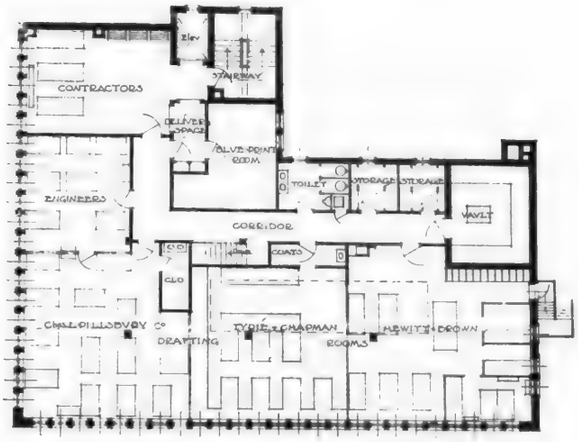
By EDWIN H. HEWITT.

(*Published jointly in the Journal of the American Institute of Architects and in* THE HEATING AND VENTILATING MAGAZINE.)

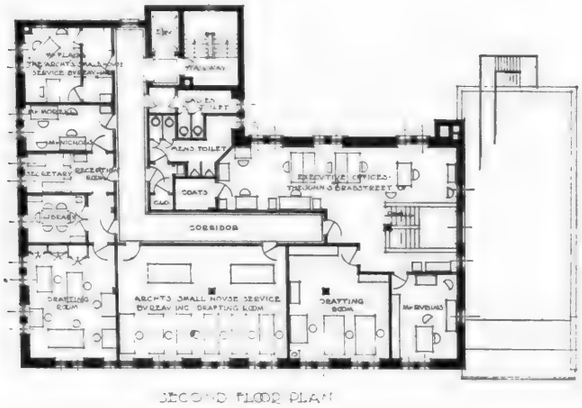
ARCHITECTS and engineers are not alone in encountering difficulties, sometimes amounting to real hardship, not to mention steadily mounting rents, in securing necessary office space in which to conduct their professional practice. Like physicians and surgeons, however, they have special requirements fundamentally necessary to the proper functioning of their practice. Hence, various interesting and valuable solutions of office arrangement and administrative equipment have been from time to time worked out. While these solutions have ranged all the way from those evolved by the smaller firms, with comparatively modest requirements, to the more important systems of the larger offices, a study of them all indicates the space problem to be a major one. Scarcely any one seems to have answered the question raised by space that is only partially or not at all used during the working hours of the day and yet which is, however, essential to the proper conduct of an architect's or engineer's practice.

It is generally found necessary to provide a lobby, or reception room, client's rooms, a room where contractors may figure drawings and obtain instructions from heads of departments, file room for the storing of technical material, as well as space for samples, provision for library, fireproof storage or vault

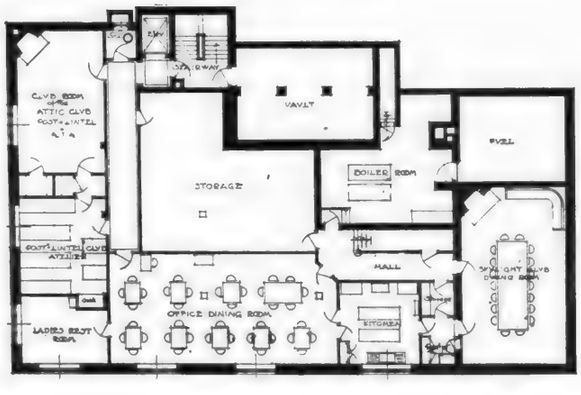
THIRD-FLOOR-PLAN



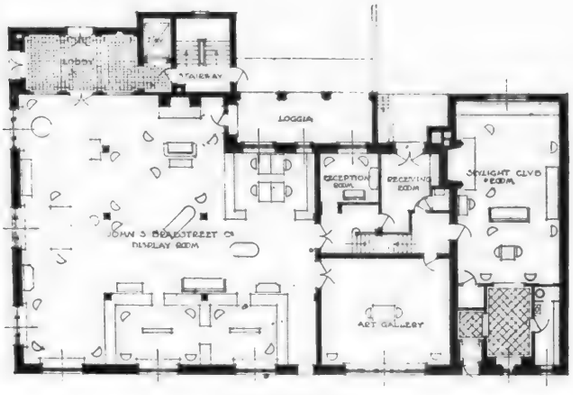
FOURTH-FLOOR-PLAN



SECOND FLOOR PLAN



BASEMENT FLOOR PLAN



FIRST FLOOR PLAN

FLOOR PLANS OF CO-OPERATIVE OFFICE BUILDING.

for the safety of original drawings, correspondence and papers, corridors and closets. In the usual office buildings, the architect or engineer finds considerable difficulty in so arranging the space to provide for the above needs that it will be convenient both to his employees and the public, well lighted, securing the necessary privacy for certain parts of the work, and yet providing for the reception of clients. Other professions, especially physicians and surgeons, have found that a duplication, in various offices, of these space requirements and arrangements necessarily places a considerable burden upon the practitioner and hence it is no new thing to find them cooperating to the extent of cutting down duplication without necessarily sacrificing their individuality in practice.

The originators of the particular building program here described conceived the idea that an association of architects could be formed in conjunction with landscape and city planning experts and a firm engaged in general engineering practice which would not only accomplish the solution of the troublesome problem of space and arrangement, but which might successfully lighten the load in the financing of a building program.

THE PRELIMINARY STEPS.

To develop the situation in a concrete way, diagrams were drawn out of the average requirements in square feet of the various offices, particular attention being paid to those portions of each plan involved—reception room, library, client's consultation, samples, storage space, which might be considered a duplication. When the diagrams were placed side by side, it was apparent at once that a co-operative use of this space would narrow down the space required for the more exclusively executive portions of these firms' requirements, and that if a higher rent be charged for the space used in common, a building could be erected and financed, providing the cost of the building site and its carrying charge in the way of taxes, etc., was not too large.

REQUIREMENTS OF BUILDING SITE.

The next step was to make a study of the available building sites, due attention being given to orientation and accessibility on the part of the public. Such a site was soon discovered near enough to the center of the city to be available to clients and business men, and in line with the general trend of growth of the city. The purchase was made, and Hewitt & Brown designed the building; then was organized the H. B. C. Building Company to finance, build, and manage the property. The plan as worked out, while modest in its proportion still demonstrates its practicability in daily use.

ARRANGEMENTS FOR RECEIVING BUSINESS CALLERS.

One of the sources of confusion in an architect's or engineer's office, especially in restricted spaces, is the coming and going not only of clients, but of material men, contractors and their foremen and others interested in building operations. This, coupled with the usual mechanism of the practice, including drafting and stenographic rooms, creates an impression of confusion which is not conducive to efficient work. Particular care, therefore, was given to the plan of directing the business so that the contractors and foremen could have access to heads of departments, the material men be received in the proper place where their information could be received and compiled, and the comfort of the client being fully considered in his consultation with the architects and engineers.

RECEPTION ROOM OF CO-OPERATIVE OFFICE BUILDING.

DISPOSITION OF WORK ROOMS.

It is a great gain so to dispose the work-rooms that they are immediately accessible and yet not in general evidence to either client or contractor. There is a gain, therefore, all around in convenience in transacting the business of the various offices. The building contains not only architects, engineers and landscape architects, but a well-known firm of interior decorators all separate and autonomous, and yet so grouped as to work separately or together as occasion would require.

SPACE PROVIDED FOR CLUB ROOMS.

In addition to the above, space is provided for several clubs

for artists and younger members of the profession who all feel the advantage of a community of interests provided by convenient space in this building.

DETAILS OF BUILDING.

The building was erected at a cost of $150,000 by the H. B. C. Building Company, and opened for occupancy the second of November, 1920. It is built on a site having a frontage of 65 ft. on Twelfth street and 110 ft. on Second avenue, and is four stories in height. The first story is occupied by The John S. Bradstreet Company, interior decorators, and the Skylight Club—the latter so arranged as to connect with the art gallery of the Bradstreet Company. This enables the rooms to be thrown together on occasion when larger space is required and special exhibitions are held.

The second floor contains the executive offices of the Bradstreet Company, the offices of Morell & Nichols, landscape architects and engineers, and the executive office of The Architects Small House Service Bureau.

The third and fourth stories are especially designed for the private offices, library, sample room, committee and client's room, blue printing room, contractors' consultation and reference room, stenographers' room, drafting rooms, and a large fire-proof vault for permanent records, drawings and correspondence. The group of professional men located on these two floors is composed of the following: Hewitt & Brown, architects and engineers; Wm. Channing Whitney, architect; Tyrie & Chapman, architects; and Charles L. Pillsbury Co., engineers. Not the least of the advantages of the plan is the special advantage and proximity and the facility for making the knowledge and experience of each available to the others. This community of interests is most delightful and helpful.

In the basement there are provided two dining rooms, one for use of the Skylight Club, before mentioned, and the other known as the Blue Print Tea Room for the convenience and pleasure of the occupants of the building and their friends. In addition to this, the dining room is available for use at the meetings of the Minnesota Chapter of the American Institute of Architects, as well as the Post and Lintel Club, composed of the younger architects of the city, and the Attic club whose members are young artists and illustrators—so that the building is used to capacity, not only during the working hours of the day and the leisure hour, but in the evening.

JOINT LIBRARY OF CO-OPERATIVE OFFICE BUILDING.

GREATER EFFICIENCY MADE POSSIBLE BY BUILDING.

It required a degree of courage and optimism to put this plan through during this last year of extraordinary difficulties. The builders had their usual number of strikes during the course of operation, financing was difficult, and yet the building company and their friends had faith that they must prepare themselves for the future; and the whole purpose in building is not merely to furnish pleasant quarters and associations, but its specific purpose is to enable the various firms to practice their professions in the most efficient manner. They feel that by maintaining efficient assistants, the more capable and better trained the better, that they can maintain their organizations to a higher point of efficiency than in their old quarters where space was maintained to carry the peak of the load when the offices were filled with work. It is apparent that with mutual helpfulness in times of strain, work can be produced efficiently and rapidly to the better interests of the profession and their clients.

A word as to style of building:

This adaptation of the Florentine or Tuscan type of design was chosen because it permitted the use of unusual spacing for the windows. There was no need of symmetry and it permitted the securing of maximum light in the drafting rooms where its need was greatest. The architects feel that they have accomplished a most desirable thing in providing a uniform distribution of light where most needed.

HEATING AND VENTILATION OF PAPER MACHINE ROOMS

An Analysis of the Problem, Showing the Need of Adequate Ventilation Together with Descriptions of Systems in Use and Proposed

By EDWARD A. RYAN

(Abstract of paper read before the Montreal Branch, The Engineering Institute of Canada, November 18, 1920, and republished by permission of the Institute.)

PROGRESS made in recent years, in the pulp and paper industry, particularly with reference to the increase in speed of machines and concentration of apparatus, has opened up a new field of endeavor for engineers, especially those interested in heating and ventilation. The problems to be solved have been rendered perhaps more difficult and require the services of a man who has made a special study of this line of work, because of the present day tendency of localizing in one centre the various processes.

The principle of ventilation, for drying, has been used from the time paper was first made, i. e. when hand pressed sheets were suspended on racks and hung up in lofts to dry, the natural air currents through open windows etc., carrying away the moisture. Then came the adoption of heated rolls, over which the sheets (after pressing) were passed, in order to accelerate the process. At first these rolls were operated at comparatively slow speeds and the moisture driven off was not in greater quantity than that which could be successfully handled by the air currents produced by openings in roofs, walls, etc. The Fourdrinier was then developed—a machine on which the pulp was mechanically formed into a continuous sheet, over a wire, replacing the previously common methods of sheet production by hand. This latter machine was then connected up to the roll drying system and two operations, of widely different character, were performed in the same room, i. e. one in which the consistency of the pulp was reduced, practically speaking, to that of water (in the mixing box ahead of the Fourdrinier) and the other in which it was increased to that of the finished paper; all of the water added in the first machine being driven off in the second.

Gradually the speed of these two machines and the widths of sheets were increased, due to improvements in design, and while in 1867 a machine to make a sheet 100 in. wide at a speed of 100 ft. a minute was phenomenal, a sheet 200 in. wide made at a speed of 500 ft. a minute is common to-day and there are machines in operation now, as also a number under construction for a speed of 1000 ft. a minute. Furthermore, it has been the practice in many cases with existing machines to increase their speed above that for which they were originally deisgned. It has thus come about that in a room of practically the same size, the quantity of water vapor produced is many times what it would have been in the early days, and exterior forces must necessarily be exerted to cause the passage of a sufficient amount of air to absorb the moisture produced.

The problem must not be considered solely from the point of view of the machine room proper, for, in the modern development comprising a group of buildings, the conditions and requirements differ very materially in the various sections. One usually has to contend with one or more machine rooms in which the heating requirements are small compared with those for ventilating, and these rooms may be connected through corridors, stair wells, elevator shafts, etc., with the finishing rooms, shipping sheds, beater rooms, screen rooms, etc., in some of which the moisture content must be maintained at a minimum and in others in which it is not so important. Owing to the intercommunication, however, a careful study must be given to the design and operation of the various systems so that conditions resulting will not produce contrary effects.

NEED FOR ADEQUATE AND PROPER VENTILATION.

It will be noted that heating is not mentioned, for the requirements to keep a paper machine room warm are negligible compared with the requirements to heat the amount of air necessary in winter time up to the desired temperature and increase its capacity for the absorption of the vapor produced in the drying process.

From a number of machine rooms, the writer finds that on an average for this neighborhood (Montreal) in minus 20° weather, the B. T. U. per cubic foot of volume to supply the radiation losses through walls, roofs, etc., amount to about 1.5, whereas the B. T. U. necessary to heat the required quantity of air to be delivered to the same room range from 10 to 20. In winter time, the heat radiated from the dryers alone is probably ample to supply the losses through walls, etc., and, in summertime, there is no need of heating but rather a great need for ventilation, in the interests of the employees' comfort, in addition to the need of absorbing the vapor generated.

It is thus obvious that the problem is essentially a ventilating one and the system, to be adequate, must absorb and carry away from the machine room the vapor produced, both from the wet end and from the drying end. If it fail to do this, in whole or in part, condensation will occur on the surface of all objects that are at a temperature lower than that of the saturation point of the air in the room, such as walls, windows, steelwork of roof and machines.

The formation of condensation is objectionable for the following reasons:

If it occur at points over the wet or dry end of the paper machine, it will drip on to the sheet of paper with a resulting poor product, frequent tearing and consequent loss of production.

In mills where the roofs are of wood, and they are by far the large majority among the older ones in this country, (Canada), condensation promotes a rapid deterioration of same. Experiments that have been carried out show that decay, or the growth of fungus in other words, begins in wood at a relative humidity of 70%, continuing at the higher volumes until a maximum is reached at which it does not go on further. It will be seen, from a typical example given later on, that even in a well ventilated mill the actual condition of the air is very near to the above critical point.

On the other hand, the advantages accruing from a properly designed and operated system, are many, the

more important of which may be summarized as follows:

Increased production, due to fewer shutdowns.

A safer place for the workmen.

A more even product.

A longer life of machine felts.

SYSTEMS IN USE.

The systems most commonly in use today are:

Gravity systems of supplying and exhausting.

Mechanical systems of exhaust only: the entering air coming in through doors, windows and other openings, the fan discharging through openings in walls or roof.

Mechanical systems of supply only: the entering air being passed over steam heated coils (in cold weather) and its temperature raised to the desired point. In summer time, no heating of the air takes place. After passage over the coils, the air is handled by a fan discharging into the machine room, through a series of ducts, the latter generally located in the roof trusses. Frequently, a portion of the total air is discharged under the machines, into the pits. Openings are left in the roof or walls, over or near the machines, for the air to pass out, after it has absorbed what vapor it can. In many plants a hood is placed directly over the dryers and at various points there are openings from these hoods to outdoors.

Systems in which steam pipes are located in the roof trusses and along walls, the air being supplied or exhausted as in the former ones.

Combination systems of mechanical supply and exhaust.

Of the first mentioned type there are still some in use but they are not satisfactory, unless in mills where the machines are of slow speed and the quantity of vapor produced is not very great.

The second type is more common than the former but there are many objections to it in a climate such as ours. It depends for its operation upon the air that will find its way to the fan through various openings to the room. In winter time, the entering air must take what heat it can from heating coils located at the roof, along walls, etc., and also from the heated dryers of the paper machines. This causes objectionable drafts, which are injurious to the health of the employees, who incidentally are not very heavily clothed, and the clothing they have on is invariably wet. Furthermore, owing to the air not being preheated, it cannot absorb as much vapor per unit of volume as it would were its temperature higher, when passing over the points at which there is a production of moisture. Then there is grave likelihood of dead air pockets, as the locations of openings for air to enter the room are not generally such as to promote the passage of air where it will be the most effective.

The third type mentioned is preferable to either of the former, provided the quantity of air be sufficient, that it be maintained at the proper temperature and that the location and spacing of the inlet ducts be such that the air will reach the proper points and that suitable provision be made for the discharge of the vapor laden air. This system is sometimes referred to as the "Sturtevant System," but since fans and heaters may be obtained from many other firms and in combination with a system of ducts used to perform the function of moisture absorption, it is hardly in order to consider it as being an arrangement on which that company, or any other in fact, has a monopoly. There are certain objections to the principle of supplying air only, for it causes the room to be placed under a pressure and some of the air, at a high temperature and relative humidity, will find its way to interconnected buildings, where it will cool down and a deposit of moisture will occur. Again, some of the air will become pocketed in skylights and at other points, which upon cooling, will cause condensation.

The combination system of supplying and exhausting mechanically is by far the best and the one in most common use in modern mills. It has none of the objections of the others and possesses many advantages, if properly designed and operated. It is more expensive to install but whether its operating cost is higher than the others is questionable, for it is difficult to measure coal and power cost with the value of increased production, savings in building repairs, smaller number of shutdowns, destroyed sheets, etc. It is flexible in every respect and possesses the great advantage that the pressure in the room may be maintained at the desired point—a very essential thing where buildings are connected together. Provision can be very readily made with this system for the recirculation of a portion of the air in cold weather—a thing that has been found to give very satisfactory and economical results, as the absolute humidity of the air is usually low when the temperature is low.

CONSIDERATIONS FOR THE DESIGN OF A VENTILATING SYSTEM.

Since it is the object of the ventilating system, primarily, to carry off from the machine room the vapor created in the process of the formation of the sheet and its drying, it is obvious that the quantity of air handled must be in direct proportion to the output of the machine or machines in the room. The writer has good reason to believe that in a great many instances this is not done in the design and that the quantities are determined from a consideration of the volumes of the rooms. This is entirely wrong, as two rooms of the same size and design, might equally well house two machines of very different capacities or again, two machines of the same capacity might very well be installed in rooms of different volumes, owing to difference of design and layout. It is interesting to note that comment is very often heard in mills of the seeming decadence of the ventilating system. Whereas in the beginning it seemed to give satisfaction, it does not appear to be maintaining as good conditions after several years of use. In some cases this is a consequence of poor operation, in others, as a result of changes made in the mill or to the system itself, and again there is the natural loss of efficiency due to age, such as growth of leakage through openings where there should not be any.

I believe that in most cases, the inadequacy of the system may be traced to an increase in production of vapor, resulting from an increase in machine speed such as has taken place in many mills recently.

As an average figure for a newsprint mill, about 2 lbs. of water per pound of air dry paper is driven off in the drying process. This figure is based on the assumption that the consistency at the wet end is 0.7 water and 0.3 pulp, and at the calenders 0.9 paper and .1 water. The former figure is of necessity subject to variation, depending on the relative proportions adopted in any particular mill.

In addition to the foregoing quantity, an allowance must be made for the moisture emanating from the process at the wet end which is absorbed by the incoming air. This quantity is difficult to specify exactly, but it is considerable, for, the condition at this point of the room might be compared to that in an ordinary humidifier or air washer—i. e. a multiplicity of water sprays and a fast moving sheet of wet paper, in process, over which air is passing. Recent tests that carried out by the writer, in a comparatively well ventilated mill, showed that there was an increase in relative humidity of 10% between a station located about 4 ft. above the third press and another about 6 ft. above the floor in the aisle, half way along the length of the dryers. It is thus apparent that in fixing upon the amount of air to be supplied to a machine room, an allowance must be made for the vapor taken up by air in passing over the

wet end. It would be wrong to make this allowance as a percentage of the total air supplied, for, while the temperature of a machine room is roughly the same in winter and summer, the condition of the air outdoors is vastly different for these periods. An opinion borne out by tests is that it is preferable to supply the air, or at least the greater proportion of it, at the wet end of a machine room.

AIR DISTRIBUTION.

The air distribution, arrangement, location and number of inlet and outlet openings play a very important rôle in the successful ventilation of a room. This is a well recognized fact by ventilating engineers and too much emphasis cannot be laid on the necessity of using sufficient

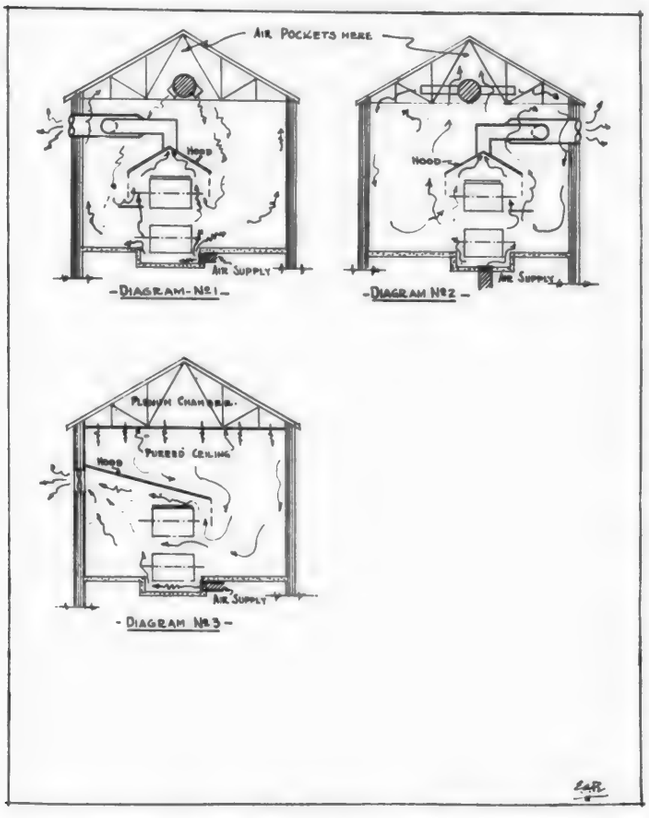


FIG. 1—TYPICAL SCHEMES FOR MACHINE ROOM VENTILATION, SHOWING PROBABLE DIRECTION OF AIR CURRENTS.

openings—a thing that is not generally done in paper mills. The customary construction of machine rooms is a peaked or flat roof supported by trusses varying in height from 7 ft. upwards. With but few exceptions, round distributing supply mains are used and these are located in the trusses. Openings are left in every bay of about 20 ft. Attempts have been made to improve conditions by directing the openings towards the roof in certain instances and downwards in others, but without much success. This design has few commendable features, the chief one being its cheapness. Its objections are many. Round ducts, in the first place, are not adaptable as are rectangular ones for the ready installation of control dampers to regulate the flow of air to the various outlets, this is a necessity with any ventilating system. Again, with ducts located in the roof trusses thus, it is not practical to get the proper number of openings and direct the air to all the points at which it is most required. The considerable number of members in the trusses, which present ever ready condensing points for moist air, cannot be easily reached throughout by the air in passage. This condition is particularly important in our climate (Canada), even though the steel be covered with cement or other protective material, for there is a continuous conductor from cold walls and roof, and if the air be anywhere near the saturation point, directly it comes in contact with these cold surfaces it will be reduced to the dew point and condensation will ensue.

The most commendable construction is that in very common use in theatres, auditoriums, etc., where an enclosed roof space is formed by furring down below the bottom of the trusses with lath and plaster or cement and leaving openings in the latter wherever required, these openings fitted with control dampers throughout. The roof space is thus converted into a plenum chamber into which the fan or fans discharge and no distributing mains are required. This method of building roofs would eliminate many of the objectionable features of the former construction referred to and in addition to the room presenting a much more sightly appearance, the general illumination would be very materially increased, particularly if the ceiling were finished a light color.

The arrangement of inlets and outlets around the dryers is of prime importance. In the design of the ventilating system, the endeavor throughout should be to control the air currents in such a way that they will converge towards this point of the room, thus preventing their escape elsewhere, once they have begun to absorb moisture. The use of hoods over the dryers is now quite common as is also the practice of blowing air into the machine pits and exhausting from the tops of the hoods. Some typical arrangements are shown on the accompanying drawings, which are diagrammatic only and do not show details, being given merely to illustrate the general principles of the schemes.

An endeavor has been made in Fig. 1 to indicate the probable direction and path of the air flow. With the first two schemes comparaitvely good results may be obtained, but they are subject to the criticisms hereinbefore mentioned as regards the use of ducts in the roof trusses. The third scheme is by far the best in the writer's estimation as the flow of air is positively one way and a better drying effect can be expected both as regards the room in general and also on the paper and felts. The value of this last consideration will at once appeal to anyone who has watched the action of the vapor at this part of a paper machine, for it has a tendency to rise from the felts of the lower rolls and pocket in the upper ones. If it be not promptly removed, a portion of the moisture has time to condense, and of course this must be re-evaporated in the upper dryers—an unnecessary repetition of process at the expense of energy. The writer has also noted from records kept that on machine rooms ventilated in the manner indicated under schemes one and two, the felts give way along the centre line and believes that this is due to the poorer circulation and drying effect at this point than at the outer edges where the circulation is better. The idea of supplying air into the machine pits is a very good one and should be adopted where possible.

The inlets to the pits and outlets from the hoods should be suitably disposed, the spacing not exceeding 15 ft. It is always preferable to use several openings of small dimensions than one or more larger ones.

Disc or propeller type fans are frequently used on the exhaust systems but care must be taken in the selection for capacity, particularly if they are connected to a duct system, as the characteristic of this type of fan is such that a very small resistance causes a material decrease in capacity.

(To be Continued.)

BACK TO FIRST PRINCIPLES

An Elementary Course in Heating and Ventilating Engineering

Lesson No. 1 — General Theory.

BY REID DAVIES.

IN PREPARING a course of study of any kind it is necessary to make some assumption regarding the extent to which prior training has paved the way for the course with those who are to take it. The present course has been prepared for the special use of the beginner in the heating and ventilating engineering profession and it has been assumed that he has completed at least a high school course or its equivalent, is somewhat familiar with the sciences of chemistry and physics and has a working knowledge of mathematics through advanced algebra.

SCOPE OF THE COURSE.

There are many sides to a successful engineer and it would be foolish to imagine that any course of instruction could cover them all. Some special phases of engineering work, such as concern accounting and financing, lie outside the scope of a general technical course and require special study to meet individual needs. Other phases, such as concern practical field conditions and the ability to deal with men—subordinates and superiors—cannot be learned from a book. Practice is essential to a knowledge of these things. But the phases which deal with scientific theory and mathematical calculation and with such matters as medical and legal requirements, are well within the scope of a technical course of instruction. By concentrating on these phases of the subject it is possible to cover considerable ground within practical space limits.

Further condensation is possible in this particular subject if the more important branch of it—that which relates to human requirements—is treated exclusively, leaving the industrial requirements—which are only relatively less important—to the special study of the more advanced student. All the essential elements of the subject are developed by the human requirement applications.

AIR THE CENTER OF INTEREST.

The main object of any engineering course is to teach ways and means to an economical utilization of materials for supplying human needs. In the heating and ventilating line the particular material around which the entire subject revolves is AIR. Air serves the human being in many other ways besides that of forced draft for his "lung furnace." To meet these many human requirements, the air in which the human being is constantly immersed must be of the proper temperature, must be pure, must contain the proper amount of moisture with relation to its temperature, and must have the proper degree and direction of motion. So the course must really cover not only the matters of heating and ventilating, but also humidification, and circulation of air. Following this first lesson, which must give a more general view of the whole subject and its related branches, attention will be confined to the subject of air conditioning for human requirements.

CONSERVATION OF ENERGY.

The prospective engineer has a few general truths to learn as a background for the infinite number of special truths which form the structure of his profession. One of these general truths concerns the conservation of energy. According to this law, energy can never be created or destroyed, although it can be transformed from one kind to another. "Boiled down brief," this means that the amount of energy put into any substance, or machine, or operation, is all that can be taken out of it. There are no exceptions to this law. Engineers can save themselves much waste effort and many disappointments in connection with new ideas by taking an energy balance between input and output on such ideas. If there is no balance, the scheme will not work no matter how alluring it looks on paper.

In all engineering work and in the physical sciences which lie at the basis of it, there is the fundamental conception of substance or matter, something tangible which can be molded and shaped to serve the purposes of man. And because science and engineering—applied science—deal with dynamic as well as static conditions of matter, there is always present in the mind of the scientist and the engineer a simultaneous conception of motion of the substance, as one of its primarily important phases.

NEWTON'S LAWS OF MOTION.

This conception of motion was so distinctly and effectively present in the mind of one great scientist that it produced the statement of three eternal laws of nature which are known as Newton's Laws of Motion in honor of their discoverer, Sir Isaac Newton. The first of these laws reads, as follows: Every material body continues in its state of rest or of uniform motion in a straight line, unless it be compelled by an impressed force to change that state. Newton's second law may be stated in these words: Change of motion of a material body is proportional to the impressed force and takes place in the direction of the straight line in which the force acts. The third law of motion can be stated in two ways: To every action there is always an equal and contrary reaction, or the mutual actions between any two material bodies are always equal and oppositely directed. Supplementary to the second law it might be added that forces always act in straight lines, so that the only way to produce motion in a curved or a zig-zag path is by simultaneous action of two or more forces or by alteration of the direction of a single force.

SYSTEMS OF MEASUREMENT.

Inseparably related to the question of matter and its motion, is consideration of the field in which it moves. In this field there are three basic quantities which form the primary factors in all engineering calculations. These quantities and their dimension names are, in the mechanical energy system, Space, Time, and Force; in the electro-magnetic energy system, Quantity, Time, and Electro-magnetic-force, and in the thermal energy system, Temperature Change, Time, and Entropy. It is in these quantities and dimensions and in their units that engineering and scientific measurements in these fields are taken and computations conducted, and these measurements are based upon two main systems of measurement, the Metric and the English. It is also of interest to note

that the quantities, dimensions, and units in the electro-magnetic and the thermal energy systems are all derived from the Space, Time, Force quantities, dimensions, and units of the mechanical energy system.

SPACE.

Of the three quantities, Space, Time, and Force, the most familiar to us is Space. The first dimension of Space is length and the linear unit is the foot. The unit of the second Space dimension, area, is obtained by multiplying the linear unit by itself, giving the square foot, which is the second power or square of the linear unit. The unit of the third Space dimension, volume, is obtained by multiplying the area unit by the linear unit, giving the cubic foot, which is the third power or cube of the foot. In computations we have often to use the fourth and higher powers of the linear unit, but these powers above the cube have as yet no physical significance for us. At present we recognize only three dimensions in Space.

TIME.

The unit of Time, the second, is the same in both the metric and the English systems. We are not yet familiar with the square and higher powers of the Time unit as separate entities, but we do know the significance of the square second as used in connection with the linear Space unit in that ratio which expresses the idea of acceleration, or the rate of change of velocity, and is written Ft. / Sec. / Sec. or Ft. / Sec.^{2}

FORCE.

Even more elusive than the idea of Time is that of Force. The Force unit of a pound is also used as the weight unit and weight is the product of Mass—that is, the amount of substance or matter in a body, and so in the ultimate analysis a volume or cubed Space unit—multiplied by the acceleration of gravitation—is a factor represented by the linear unit divided by the squared Time unit and written 32.2 Ft. / Sec.^{2}

THREE KINDS OF FORCES.

Engineers have several kinds of forces to deal with. One kind is the gravitational force which is a controlling factor in all forms of mechanical motion. Another kind is the electro-motive force which is a controlling element in all electro-magnetic phenomena. Of special interest to the heating engineer is a third kind, the thermal force, which is a controlling factor in all thermal phenomena. Because the heating engineer must deal with mechanical and electro-magnetic, as well as with thermal problems, it is necessary that he should understand the relations between these three kinds of forces and the phenomena associated with their action upon material bodies. This understanding can be best given by showing the analogies between the three force systems. Here it is that the science of mathematics becomes of particular value, because one very clear and simple basis for these analogies is supplied by the mathematical relations between the quantities, dimensions, and units in each of these force systems.

MECHANICAL ANALOGIES.

In order to compare the three kinds of forces and the units associated with them, there are shown in the accompanying illustration three systems in which the operations are practically the same. All are closed circuits. All produce alternating currents. Each has a prime mover that is fundamentally reciprocating in its action. The three properties of a circuit are shown in corresponding positions in each system, as if concentrated for convenience of representation. The electro-magnetic circuit is such as might serve a useful purpose. The thermal and mechanical circuits shown, are not such as would ordinarily prove of any present-day use. Their usefulness is confined to the immediate purposes of illustration for which they were designed. The thermal system shown should be explained as illustrating principally the convection effects of the heat application, since the radiation and conduction effects would tend to produce an equal heat flow in both directions in this system.

CIRCUIT PROPERTIES.

Considering now the properties of the three circuits shown, the friction in the thermal and mechanical systems corresponds to the resistance in the electro-magnetic system, and can be briefly explained as an effect which opposes velocity or change of position of the mediums, air, water, and electricity, respectively, which are flowing through these three circuits. The inertia in the thermal and mechanical systems corresponds in the same way to the inductance in the electro-magnetic system and can be briefly explained as an effect which opposes acceleration or change of velocity of the three mediums. Finally, the resilience in the thermal and mechanical systems also corresponds to the capacity in the electro-magnetic system, and the best explanation of this effect is the statement that it is the opposite of the inertia effect and aids acceleration or change of velocity of the mediums.

In the thermal system shown the actions are evidently thermo-motive in character and to get a more strictly thermal conception a system must be imagined in which the action is quite similar to that in an electro-magnetic circuit and in which the friction is replaced by a path of low conductivity, the inertia by a path of high absorptivity and the resilience by a path of high expansibility. These last two terms are manufactured for the occasion to represent recognized thermal effects (that have, however, not been previously named) which correspond to the inductance and the capacity effects, respectively, in the electro-magnetic circuit.

MATHEMATICAL ANALOGIES.

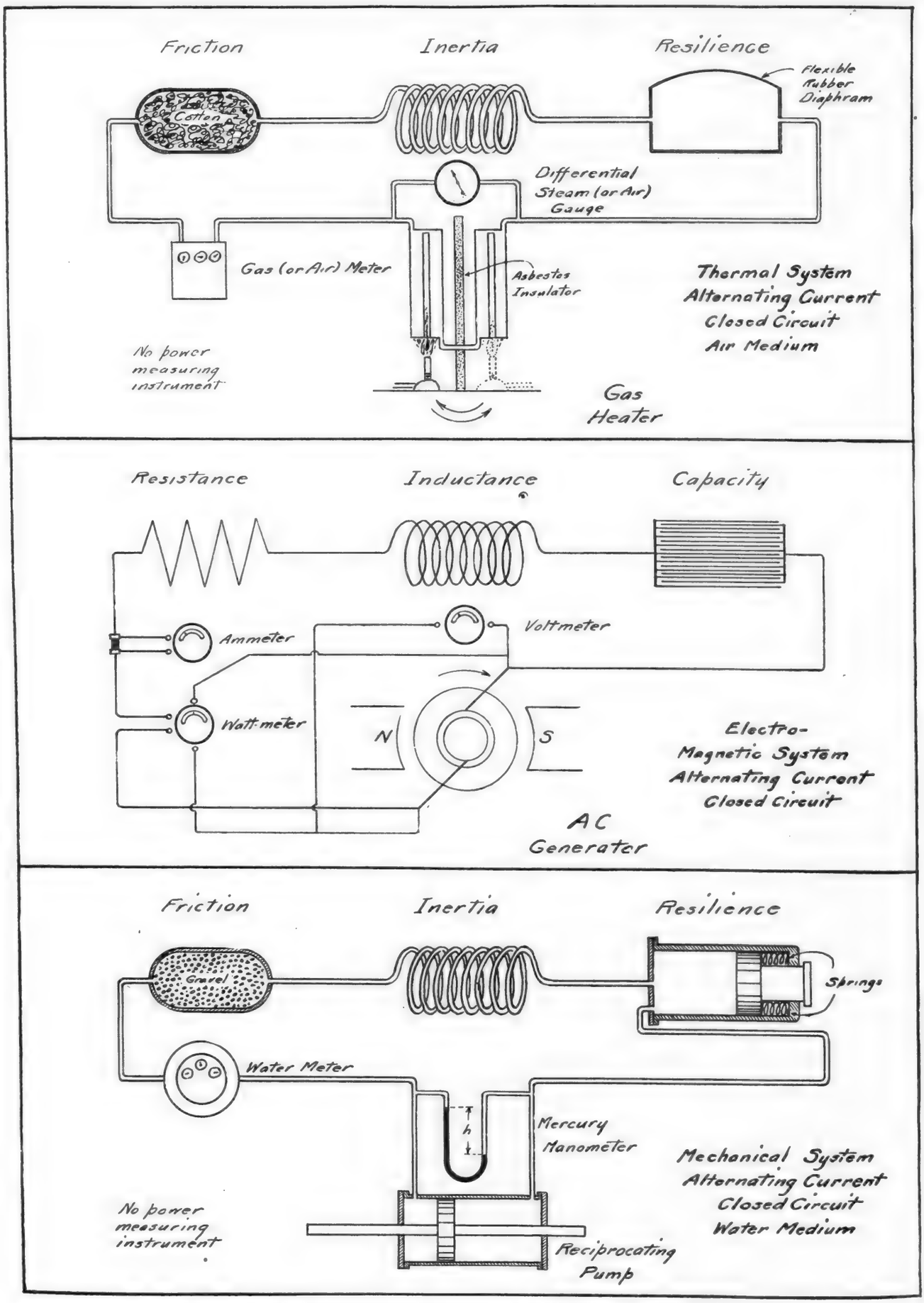
Perhaps a more complete analogy between the thermal, electro-magnetic, and mechanical force systems is given in the accompanying table in which the corresponding quantities, dimensions, and units in these three systems are placed opposite each other to aid in the comparison, and in which the derivations and mathematical expressions and interrelations of units are also given as a further aid to comparison. In connection with the several elements compared in this way, emphasis must be laid upon the fact that the corresponding elements are not equal but that they act the same way in mathematical equations. That is as far as present knowledge extends. Another fact concerning this table to which attention should be called, is that under the heading of Derivation are given for each dimension or unit, merely the variable factors entering into its determination. Constants which would have no value from the standpoint of analogy and would only serve to complicate the matter, are omitted. For instance, the variable factors in determining inductive reactance are henrys and seconds as indicated by the ratio henrys/seconds. But the actual value of inductive reactance in any circuit is 6.2832 x frequency (in cycles / second) x henrys, or this may be written in the following form

inductive reactance = 6.2832 x cycles x henrys / seconds

In that equation the product of 6.2832 x cycles is a number which relates to the special conditions of each circuit and has no bearing on the ratio between the inductance and time units other than that of a coefficient.

A GLANCE INTO THE FUTURE.

A glance at this table can be considered as a glance into the future of engineering. There are enough cases where quantities, dimensions, and units in the three systems correspond, to indicate rather conclusively that this correspondence is complete and that the future will see a filling in of the holes which now appear in this table. For instance, velocities



DIAGRAMS SHOWING ANALOGOUS PROPERTIES OF MECHANICAL, ELECTRO-MAGNETIC, AND THERMAL ALTERNATING CURRENT CIRCUITS.

MECHANICAL				ELECTRO-MAGNETIC				THERMAL			
QUANTITY	DIMENSION	UNIT	DERIVATION	QUANTITY	DIMENSION	UNIT	DERIVATION	QUANTITY	DIMENSION	UNIT	DERIVATION
Space	Length	Foot	Arbitrary—1/3 length of standard yard model		Quantity	Coulomb	Amperes x Seconds Quantity of electricity supplied by a current of one ampere during one second		Temperature Change	Deg. F.	1/180 of the range of temperature between the freezing and the boiling points of water (Fahrenheit scale) at a barometric pressure of 760 millimeters of mercury.
	Area	Sq. ft.	Feet x Feet								
	Volume	Cu. ft.	Feet x Feet x Feet								
Time		Second	Astronomical—1/86,400 part of a mean solar day	Time		Second	Defined under Mechanical	Time		Second	Defined under Mechanical
Force	Gravitation	Pound	Arbitrary—Weight of standard model	Force	E. M. F. Electro-motive Force	Volt	Amperes x Ohms Electrical force necessary to produce a current of one ampere in a circuit whose impedance is one ohm.	Force	Entropy		(This is the thermal force quantity which corresponds to the mechanical and electro-motive forces in the other systems)
	Velocity		Feet/Seconds		Current	Ampere	Physical definition in C. G. S. system of units		Rate of change of Temperature		Degrees F./Seconds
	Acceleration		Feet/Seconds^2		Rate of change of Current		Amperes/Seconds				
	Rate of change of Force		Pounds/Seconds		Rate of change of E. M. F		Volts/Seconds				
	Pressure		Pounds/Sq. Ft.								
	Power		Lbs. x Ft./Sec. Force x Velocity		Power	Watt	Volts x Amperes Force x Current				
	Energy		Power x Time Pounds x Feet Length x Force		Energy	Joule	Power x Time Volts x Amps. x Sec. Quantity x E.M.F.		Energy	B. T. U. British Thermal Unit	Entropy x Deg. F. abs. (in the isothermal changes of a gas) Lbs. x Temperature Change in Deg. F.
	Friction		Force/Velocity Lbs. x Sec. /Ft.		Resistance	Ohm	Volts/Amperes				
					Conductance	Mho	1/Resistance Amperes/Volts		Conductivity		Rate of change of Temperature (Deg. F.) divided by Entropy
	Inertia		Force/Acceleration Lbs. x Sec.^{2}/Ft.		Inductance	Henry	Volts x Sec./Amps. Inductance which creates a counter E. M. F. of one volt during a current variation rate of 1 ampere per second		(Absorptivity)		Entropy x Seconds^2 divided by change of Temperature in Degrees F.
					Inductive Reactance	Ohm	Volts/Amperes Henrys/Seconds				
					Inductive Susceptance	Mho	Amperes/Volts Seconds/Henrys				
	Resilience		Elongation (Length) divided by Force Feet/Pounds		Capacity	Farad	Coulombs/Volts Amps. x Sec./Volts Capacity which is charged with one coulomb across a 1 volt potential		(Expansibility)		Temperature change in Deg. F. divided by Entropy
					Capacity Reactance	Ohm	—Volts/Amperes —Farads/Seconds				
					Capacity Susceptance	Mho	—Amperes/Volts —Seconds/Farads				
					Impedance	Ohm	Volts/Amperes Square root of (Resistance^2 plus the square of the sum of Inductive Reactance plus Capacity Reactance)				
					Admittance	Mho	1/Impedance Amperes/Volts				

TABLE SHOWING MATHEMATICAL ANALOGIES BETWEEN QUANTITIES, DIMENSIONS, AND UNITS IN THE MECHANICAL, ELECTRO-MAGNETIC, AND THERMAL FORCE SYSTEMS.

will probably become of sufficient importance at some time in the future to merit and receive some unit name. In the same way it is probable that at some future date the need will arise for a thermal conception corresponding to the mechanical conception of friction and the electrical conception of resistance. Finally, it is well within the bounds of probability that the future will see the development of alternating velocity mechanical systems and of thermal systems with alternating rate of change of temperature, which will correspond to present alternating current electro-magnetic systems and which will serve some useful purpose. Such development will make essential a far better knowledge than we now possess concerning the properties of the mechanical and the thermal circuits. Possibly a better knowledge of these properties will be the cause, rather than the effect of this development.

This completes the text portion of the first lesson. The second lesson will deal with the subject of Heating, with special reference to all factors relating to the heating of air for populated interiors.

Following this lesson are given a list of reference books, from which a diligent searcher can glean a fund of information to supplement the lesson itself, and also a list of questions based upon the lesson and which can be used to advantage by the student in the obvious manner.

Reference Books.

A Text-Book of Physics, by Watson—Longmans.

Heat for Advanced Students, by Edser—Macmillan.

Elements of Heat-Power Engineering, by Smith, Hirshfeld, and Barnard. —Wiley.

Engineering Thermodynamics, by Hirshfeld—VanNostrand.

Experimental Electrical Engineering, by Karapetoff—Wiley.

Magnetism and Electricity for Students, by Hadley—Macmillan.

Questions.

1. What is the most important branch (or application) of heating and ventilation?
2. What material or substance lies at the foundation of all heating and ventilating problems?
3. What are the conditions regarding this substance which are dictated by human requirements?
4. Give a broader name for heating and ventilating engineering?
5. Is your main objective, service or wealth?
6. State the law of conservation of energy.
7. Give Newton's Laws of Motion.
8. What are the fundamental units in the metric system of measurements? In the English system?
9. Why is a change from one to the other difficult?
10. Name three kinds of forces of interest to the engineer?
11. How can analogies be drawn between these force systems?
12. In what ways are the three systems in the illustration similar?
13. What are the properties of the circuits in these three systems?
14. Do you understand the action in these systems? If not, what do you not understand about it? What would be a good way to remove this lack of understanding?
15. What is the relation between a foot, a coulomb, and a temperature change of 1° F.?
16. What is the relation between a pound and a volt?
17. What is the relation between a velocity, a current, and a rate of change of temperature?
18. What is the relation between friction and resistance?
19. What is the relation between inertia, inductance, and absorptivity?
20. What is the relation between resilience, capacity, and expansibility?

INSTRUCTION COURSE FOR CUSTODIANS AND JANITORS

Lesson No. IV—Low-Pressure Steam Heating (Concluded)

By EDWIN S. HALLETT

Chief Engineer, St. Louis Board of Education

HOW TO HANDLE BLAST-FAN HEATING PLANT.

CUSTODIANS and engineers who have had no experience with the modern all-blast or split systems of heating may well hesitate before assuming such responsibility, for there is certain definite instruction necessary to the proper or satisfactory operation of such apparatus.

Both steam engines and electric motors are used for power to drive the fans. The speed should be determined for each plant and the governors set so as to maintain uniform speed. In the case of steam power it is necessary to keep a uniform pressure, for when the pressure drops, the governor can not furnish power which is not there. Low-pressure steam makes excellent power for the fan when even pressure is carried. Some good damper regulator ought to be installed to assist in holding an even pressure. It is disastrous to the heating service to have varying fan speed. Do not slow down when it gets warm and little heat is required. This is the most common fault.

CARE OF THE ENGINE.

Low-pressure steam engines require all the attention that large power plants do. They may run in a manner, but these lessons are intended to help make them run right. Low-pressure steam carries more condensed water and care must be taken in starting a cold engine. Give plenty of time, say one or two minutes, for the steam to flow through the cylinder before it begins to move. Let it blow through the cylinder cocks for a few minutes before coming up to full speed.

Before starting the cylinder lubricator should be started to feed observing that the drop of oil rises through the sight feed at the rate of one or two drops a minute. That seems slow, but great damage is often done by using an excess of cylinder oil. But just as great care must be taken to keep oil going into the engine constantly. A purring or groaning sound in the cylinder indicates a lack of oil. The bearings of an engine must have oil or grease constantly and there should be a means of using an excess of oil and returning it for re-use. The

splash system for the crank pin and main bearings is very effective if the oil is changed at intervals of a month or so.

Do not add fresh oil to the old, but clean and wash out the crank case with coal oil and refill to the proper level. Do not let it get too high. The best oiling system is one having a storage oil tank high enough to run by gravity to all the bearings through sight feeds, collected in a reservoir or filter and returned to the storage by a small pump. This admits of a liberal use of oil and reuses it as long as it is fit. Many custodians improvise such systems and return the oil by hand after filtering.

Where grease cups are in use they must have daily attention to see that the grease is going into the bearing. Rocker bearings and the wrist pins which do not turn entirely around are more difficult to lubricate as there is no means of getting the oil around. Oil grooves must be kept open in bearings. A bearing which has run quite hot, just hot enough to start the babbitt to melt will never run right until the surface of the babbitt has been scraped smooth and to fit the shaft. Watch the machinist do it before attempting it yourself.

New bearings run warm for a while, likewise a bearing that is too tight. Watch such a bearing closely, keeping it well oiled with a light oil, but do not slack up on the bolts. If it was caused by being too tight it will soon begin to cool down but if it does not, it is probably out of line, that is, the shaft is in a strain or sprung or out of alignment.

The custodians should learn to key up and pack the engines. There are many kinds of noises produced by engines one of which is the knock of loose bearings. The connecting rod having the crank and wrist bearings are made in two common forms; one keying up by means of a wedge within the connecting rod and the other, like the automobile, is adjusted by removing shims or thin metal or paper liners. It takes long experience to become proficient in keying up. A bearing brought up tight must be backed off to run. It should be set right and not started too tight and trust to its getting loose enough. Where several bearings are being keyed up, fit one just right and slack off while the next is being adjusted so that the resistance of one bearing at a time may be felt. A good engineer will not have to get into his bearings very often. A bearing must have time to wear in a good seat.

THE MEANING OF PLENUM HEATING SYSTEM.

The word plenum signifies that the chambers and ducts are filled with conditioned air. Plenum is the opposite of vacuum. It is a fundamental of good heating that the building as a whole shall be kept under some air pressure above atmospheric. The fan is for that purpose. The demands of present-day heating systems have created the various forms of multivane blast fans which produce a high static pressure. The old style of plate fans produced, principally, pressure due to the momentum of the air and only pressure of low value could be carried to the ends of long ducts. The new fans have corrected this.

MAINTAINING A UNIFORM FLOW OF AIR.

Great effort has been made to secure a uniform air motion in school rooms and at the same time have a means of heat control that would hold each room individually at the right temperature. This is done with the hot room and tempered air room, and thermostatically-operated mixing dampers. The reheating coils have a by-pass under them for the tempered air. The custodian must learn to handle the temperatures of these rooms, or the whole system will be in disrepute, as is often the case. Nothing can be said in these lessons of more importance than the directions here given for handling these rooms. These rules vary with the season or outside temperature. Cold-weather running will be considered first.

COLD WEATHER OPERATION.

The cold air from the intake passes through tempering coils to the air washer. The outside air will have a variable humidity which will be equalized in the air washer as the mist nozzle washer will raise the relative humidity to 80% or 85%. The temperature of the washed air should be kept between 55° and 60° if possible. This is assuming that there is no automatic humidity control in use. If the windows begin to sweat, lower the temperature of the washed air. In reusing the air of the building discontinue the regular mist nozzles and put in a row of flooding nozzles close up to the top of the scrubbers to avoid an excess of humidity.

Do not shut down the air washer in cold weather as it is most necessary then. If the water freezes it is probable that the tempering coils are not working properly. If they are controlled by a thermostat it should be placed between the washer and the next heating coil. It is of greatest importance that the custodian study the air washer and keep it in operation at all times except when it is actually raining.

A single additional heating coil is usually placed immediately after the washer to raise the temperature of the tempered air room at the mixing dampers. The use of this coil is one of the most common sources of trouble, as in raising this temperature to near the room temperature there are no means of holding the room down to 70°. A little leakage in the hot air damper would make it impossible to maintain temperatures low enough. This coil should be controlled by hand. The reheating Vento or pipe coils are set up to make a by-pass under them for tempered air to dampers. In the latitude of St. Louis four reheating coils in series are necessary to bring the hot air up to 140° degrees with the usual velocities. The hot air would not be carried so high except in cold weather. The skill of the custodian must be exercised here. So long as all the dampers are taking hot air exclusively it is not hot enough. When the graduated thermostats generally begin to open the dampers to the tempered air, the correct temperature has been reached in the hot rooms.

HOW TO BRING UP A COLD ROOM.

Occasionally a building will heat properly with the exception of a single room. It may be due to a very long duct cutting down the velocity to the room. The volume damper may be partly closed. The vent register may be closed. The wind may be blowing briskly on this side and the windows may not have weather strips. The door to corridor may be open. The hot room temperature may be too low. The fan may be running too slow. The thermostat may not be operating properly. Any one or all of these causes may contribute to the failure of the room to heat. If the incoming velocity is good, try stopping off part of the vent register, but never all of it. If the duct is taken out of one side of the hot-room and especially if the fan is an old style plate vane, a deflector may be useful. The trouble can generally be corrected without installing direct radiation in the room. With split systems having heat regulation on the radiators, great care must be used in properly tempering the air. It should be kept close to 70° in moderate weather and as much warmer in cold weather may be necessary to supply the heat so that the radiators may control the temperature.

Questions on Lessons 3 and 4.

1—What determines the choice of a heating boiler?
2—What kind is required for low-pressure power?
3—What are the objections to plain grates?
4—How are furnaces adapted to hard or soft coal?
5—How does the down-draft furnace prevent smoke?
6—How can plain grates be fired without smoke?
7—How may air leaks in furnaces be detected and repaired?
8—How can heating system layout be best done?
9—Describe the essential parts of a blast heating system?
10—What are the distinctive features of all-blast and split systems?

11—What determines whether an engine or motor shall be used?

12—What is required as to speed of fan?

13—Name five things to observe in handling of an engine.

14—What is the significance of "plenum heating system"?

15—What device permits a uniform flow of air?

16—Trace the air through the several pieces of apparatus?

17—Why are two stacks of heating coils placed in the intake?

18—Name three changes produced on the air by the washer?

19—How may the air washer become a fair humidity regulator?

20—How are the temperatures of the air determined?

21—How can a cold room be quickly brought up?

WHY STEAM IS FAVORED AS A HEATING MEDIUM

With Suggestion As to Most Suitable Type of Steam System to Use in Any Given Case

By JOHN D. SMALL.

(Abstract of paper presented at February meeting of Illinois Chapter, American Society of Heating and Ventilating Engineers.)

I presume that the main reason why steam heating has been adopted more universally than water heating is the initial cost of the installation which, only in exceptional cases, is a secondary consideration. From my experience and observation, the first cost is the main consideration in most instances when letting contracts. The conditions, however, in my opinion, should govern largely as to the type of system to be adopted in the original design, with due regard both to first cost and operation. There is no system of heating that can or should be applied to all buildings and yet there are valid arguments for the various systems in various classes of buildings.

A case in point was a factory building where three systems of heating were given careful consideration and all parties submitted layouts and estimates and accompanied the same with arguments as to why their respective systems were just the thing for this particular installation. One was for water, one for fan blast and one for steam. At that time the unit heater had not been exploited. In this case forced water heating was adopted.

WHERE WATER HEATING SYSTEMS HAVE THE ADVANTAGE.

There is no doubt that forced water heating has advantages in large industrial plants where uniform temperatures can be maintained by means of centralized control, thus making for economy in operating cost. However, there are many instances where steam heating can be applied with greater flexibility to care for various requirements, due to the arrangement and use of different sections of the plant, and changes can be made with less danger of unbalancing than with hot water. This would apply especially to the two-pipe vacuum steam heating system where the sizes of pipes are not so important, as long as they are large enough to supply the steam required, as the balancing is effected by the traps employed at the return end of all heating units and at the drainage points of mains.

ADAPTABILITY OF STEAM IN REMODELING ANTIQUATED HEATING SYSTEMS.

Right here is a great advantage of the single-pipe or two-pipe gravity steam types in remodeling antiquated heating systems. Where the steam supply mains are really larger than necessary for a two-pipe vacuum system and where formerly short-circuiting was the cause of unsatisfactory heating, the application of vacuum traps to such a system balances the same and causes the steam to flow to all parts, thus establishing thorough distribution as long as there is enough steam to fill the system, regardless of the large supply pipes in the single-pipe systems, or large return pipes, as in the case of the two-pipe gravity system.

POINTS TO BE CONSIDERED IN HEATING BUILDINGS.

The points to be considered in the heating of buildings are:

First cost.
Operating cost.
Central or local control.
Continuous or intermittent operation.
Possibility of freezing.
Time element in heating.
Apparatus required to operate.
Tempering heaters for ventilation.

For residences, except country homes which are closed for the winter, the gravity water heating system is the ideal method of heating, with damper regulator thermostatically controlled, as this system is best adapted for all seasons of the year. It is also automatic under all weather conditions and requires practically no individual control of radiators, as the temperature of the water is regulated to suit weather conditions.

For country homes for a short period in the Spring and Fall, either a single-pipe gravity steam system or a vapor heating system would be more desirable, as these systems will drain to the boiler when shut down and are not so liable to freeze with intermittent operation. They can also be drained by an inexperienced attendant.

For the average church, a single-pipe gravity steam system is the ideal system for intermittent operation and for quick heating and is safer fram the standpoint of freezing.

For the average school, a single-pipe gravity steam system, with temperature regulation for direct heating and possibly a two-pipe gravity steam system, with condensation pump and receiver for blast heaters, and temperature control, is the most desirable.

For large schools the two-pipe vacuum steam system for both direct and blast heaters, with temperature control throughout, is the ideal method, where the split system of heating and ventilation is used. The steam system is more desirable for schools as against hot water for the same reason as apply to churches, with regard to the possibility of freezing when closed on holidays.

For club and lodge buildings of the smaller class, either steam or hot water might be used, but for the larger class, of the skyscraper type, a two-pipe vacuum steam system is popular.

For apartment buildings of moderate size the vapor system is quite desirable, where a degree of temperature control can be obtained by means of the graduated valve on the individual radiators. On account of the large pipe sizes in the vapor system, it is advisable to resort to the two-pipe

vacuum system on the larger buildings of this class, with top-feed radiators equipped with lever-handle valves placed at the top of the radiators for convenient operation.

THE REQUIREMENTS FOR HOTELS AND OFFICE BUILDINGS.

For hotels the two-pipe vacuum steam system is probably the most practical as it insures a quick, positive steam supply to all parts of the building on demand, the greatest demand being in the morning when the patrons open the radiator valves upon arising, and as the average transient stopping at a hotel is not so much interested in temperature regulation as in getting steam when he wants it, this system, in my judgment, meets the hotel requirements better than any other.

For office buildings, the most popular type of heating systems is doubtless the same as for hotels, with the addition of automatic temperature regulation throughout, as the tenants spend seven or eight hours in their offices and not only want the temperature right, but do not want to bother with the radiator. Incidentally, there are a number of very successful air-line vacuum heating systems in connection with single-pipe gravity steam jobs in large office buildings.

For small railroad stations, the two-pipe gravity water heating system is the most practical for general conditions, as the water temperature may vary considerably and the waiting room will be reasonably comfortable. This system also requires less care and attention than steam.

For large railroad stations either the two-pipe vacuum steam system or forced water heating system are equally desirable, except that where pipes are to be concealed, the steam system would be preferable, due to the possibility of leaks in the water heating system.

For hospitals, the two-pipe vacuum steam system is best adapted as, in most cases, the risers are concealed in outside walls, which would be objectionable with water heating. Windows are open to a considerable extent, thus causing a big drop in water temperature. There is greater danger due to freezing on account of the open windows, and the general economy would be lessened.

For institutions consisting of a group of buildings, either the two-pipe vacuum steam system or the forced water heating system would give good results and the nature of the institution would have some bearing on which system would be more economical.

For small factories, a single-pipe or two-pipe gravity steam job would suffice, providing the boiler room were low enough to permit of gravity return.

For industrial plants, consisting of groups of buildings, as stated in the beginning, the forced water heating system has an advantage from a standpoint of operating cost over the entire heating season, due to centralized temperature control. The upkeep possibly is less, but in the general heating field the various steam and vapor heating systems better meet the many conditions presented to the heating engineer and are more flexible.

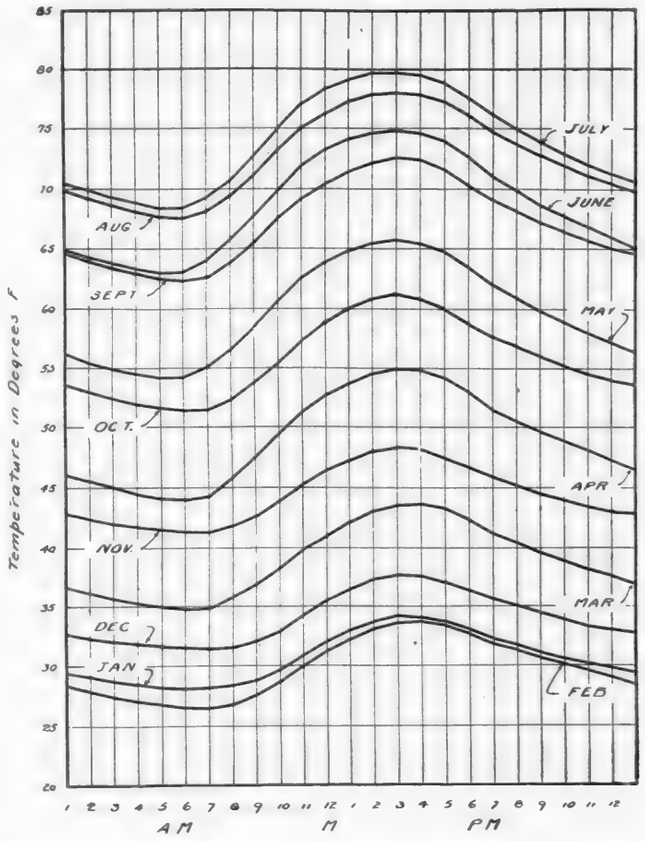
The Daily Temperature Cycle by Months.

BY HUMPHREY EVANS.

In an article entitled "Some Temperature Probabilities for April," appearing in THE HEATING AND VENTILATING MAGAZINE for March, there was given a curve showing the hourly temperature variations in New York during April, taken from the average of readings covering a number of years. This curve proved of considerable interest to me, enough so, in fact, to inspire an investigation of the same variations for the other months of the year, which research is herein presented in the accompanying chart, covering the entire year for the same district and period.

Prior to this study and charting, it had not been quite clear to my mind why the author of the above-mentioned article had chosen the month of April for his charting of hourly temperature variations. The result of my own study gave a clear explanation.

There is an arbitrary standard in the heating profession—which does not appear to include, necessarily, either the owners of apartment houses or the janitors of the same—to the effect that artificial heating is required whenever the outside temperature falls to 50° F. or below. A glance at the series of curves for different months in the year shows at once that the month of April is the only one in which the average temperatures range both above and below 50° F. from one time of day to another. In the case of all the other months



AVERAGE DAILY TEMPERATURE CYCLE IN NEW YORK CITY BY MONTHS.

the average temperatures are either entirely above or entirely below this figure.

From inspection of these curves it is at once evident that during five months of the year, November to March inclusive, there is needed on the average in the New York district, artificial heating during the entire period between thhe rising hour of 7 a. m. and the retiring hour of 11 p. m., assumed by Reid Davies as representing standard practice. This applies to residential requirements and is a theoretical minimum. In actual practice there is realized a considerably shorter heating period, as can be affirmed by many of the "cliff dwellers" in New York.

Another point of interest brought out by these curves is the fact that throughout the year the character of the daily rise and fall of temperature remains much the same, a minimum being attained between 5 and 7 a. m. and a maximum between 2 and 4 p. m. The average daily range is, however, considerably less during the months of extreme cold, January and February, than during those of extreme heat, July and August.

To the electrical engineer the yearly rise and fall of temperature appears at once as analogous to a simple harmonic wave of alternating voltage or current, as shown by the oscillograph, while the daily rise and fall of temperature shows similarity to the higher harmonic wave of an increased frequency. The combination has features reminiscent to the electrical engineer of the irregular voltage and current variations in an alternating current circuit under practical load conditions.

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STARTING in this issue there is presented a feature which, we think, will appeal particularly to a certain class of our readers for whom we cherish a very warm—even though necessarily impersonal—interest and to whose efforts we look with great hope for the future development of the art and science of heating and ventilating. We refer to the young men just starting their careers in the engineering branch of this industry.

In the process of serving the publicity requirements of a live industry, it is inevitable that much material will be handled in a style and in terms that are largely Greek to the beginner. By presenting an elementary course on heating and ventilating engineering, we aim to alleviate, at least in a measure, the difficulties of the present-day engineering beginner and at the same time possibly afford to the established engineer a welcome review of fundamental theory. To the latter class among our readers may be found of special interest and value, a mathematical comparison of quantities, dimensions, and units in the mechanical, electromagnetic, and thermal force systems, which forms one feature of the first lesson in this course and is contained elsewhere in this issue.

IT WOULD be difficult to imagine a greater variety of objections than those that are raised when a heating ordinance, designed to insure comfortable living quarters in cold weather, is proposed. It does not seem to make any difference where the city involved may be located, any effort in this direction is immediately beset with a storm of adverse comment and thinly-disguised ridicule which, more than once, have had a decisive effect.

Following the recent side-tracking of the proposed heat ordinance in Chicago, interested citizens of Kansas City naively came to the fore with a similar proposal for that city. The measure passed the lower house of the city council before its opponents really got busy. They had, however, managed to make their presence felt, for we read that "to meet an objection that unscrupulous tenants might take advantage of landlords by raising windows, a section was added providing that all doors and windows shall be kept closed for an hour before a test is made upon which a complaint is based." As in previous cases, the time-worn argument was then advanced that it was impossible to heat a house to 68° F. continuously and the usual explanation was made that the proposed ordinance applied only to living quarters. A serious phase of the discussion was reached, however, when the statement was made that years ago such a measure might not have been necessary as people could move if they did not like conditions, but as matters now stand, people very often have no other place to go.

Another typical argument is to the effect that unscrupulous landlords will find a way to circumvent the law. In Baltimore, for instance, where a heating ordinance is also pending, a clause has been inserted to the effect that it shall apply "only in the absence of a written contract to the contrary." With this loophole, it is claimed, tenants who cannot find another place to go would be forced by their landlords to sign leases or agreements waiving right of action under the provisions of the law.

It is evident that a heating ordinance which will pass muster must be drawn up with the wisdom of the gods and guided to final passage with the patience of a Job.

AS HAS been pointed out more than once in these columns, the development of humidifying devices, such as would be suitable for installation in residences, offices and similar quarters, or which could be applied directly to warm-air heaters, has shown less progress than almost any other item in the list of devices used for securing comfortable indoor conditions. An investigation of this condition shows that there is not so much a lack of attempt to provide adequate devices, but that the requirements have not been fully appreciated, apparently, even by the designers. Certain it is that the public has had only a faint conception of the requirements to be met. In order to give our readers an idea of the development of this type of humidifier to date, we will inaugurate, beginning in the May issue, a series of illustrated descriptions of the humidifying devices now on the market, showing their principal characteristics. These descriptions will appear under the general heading of "Humidifying Devices for the Home."

WRINKLES

Use of Heating Systems for Cooling Rooms in Summer.

A scheme for cooling living rooms in houses and apartments, sleeping rooms in hotels, also small offices, factories, etc., by utilizing the heating system already installed was proposed by a New York heating and ventilating engineer, A. M. Feldman, at the heating engineers' recent meeting in Philadelphia.

As will be noticed from the accompanying illustrations, the first requisite is a change in the radiator connections from the conventional method, Mr. Feldman stating that our adherence to bottom radiator connections, necessary for steam and suitable also for two-pipe water heating systems, was the cause of the slow progress in the art of using radiators for cooling purposes. As he pointed out, radiator connections are always brought up through the floor in steam and two-pipe water heating. Even in vapor heating, where the steam connections are made at the top of the radiator, they are carried down to the floor before entering risers.

With such connections radiators filled with cold water will not circulate; as the water extracts the heat from the air it is warmed and tends to rise to the top of the radiator and would not leave it, since there is no top straight connection to the riser.

In the scheme as outlined by Mr. Feldman, water type of radiators are used, in addition to the heater, there is a cooler in the circuit. Valves, of course, are provided for cutting in the heater and cutting out the cooler, or vice versa. The flow through the system, when the heater is cut in, is downward through the radiators, but when the cooler is cut in, the flow is reversed, passing upward through the radiators. The cooler can be located either in the basement or the attic and may be supplied from a refrigerating machine or use made of cold well water. In the later case it is figured that the system would be capable of reducing the temperature at least 5° when the cooling medium was not lower than 50° to

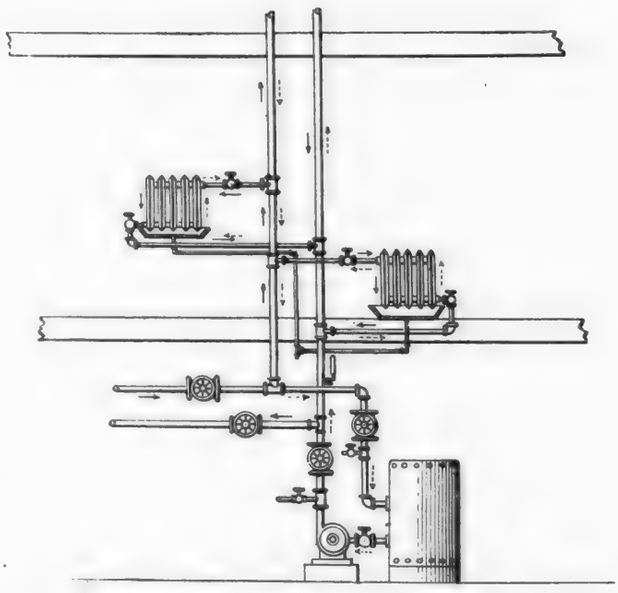
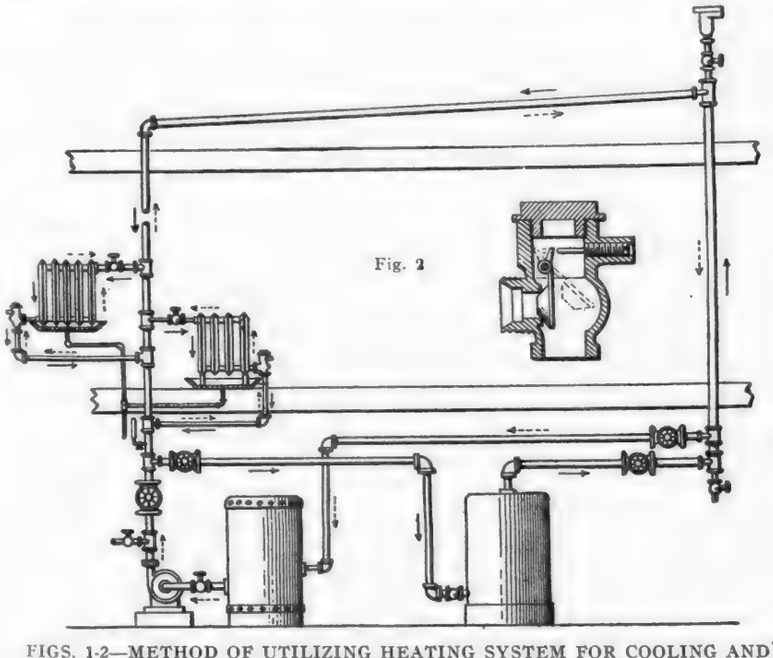


FIG. 3—ADAPTATION OF COOLING TO A SECTION OF A HEATING SYSTEM.

60. This would be quite effective, since it is well-known that a drop in temperature should never be more than 8° or 10° in comparison with the outdoor temperature.

In the illustrations the full-line arrows indicate the flow of water when the circuit is used as a heating system and the dotted arrows indicate the water flow when the system is used



FIGS. 1-2—METHOD OF UTILIZING HEATING SYSTEM FOR COOLING AND SPECIAL CHECK VALVE FOR USE WHEN SYSTEM IS OPERATED FOR HEATING.

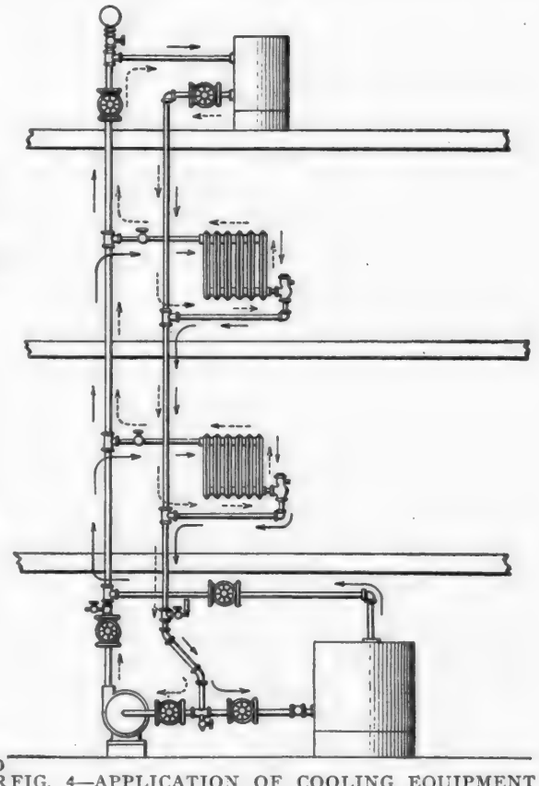


FIG. 4—APPLICATION OF COOLING EQUIPMENT TO A HEATING SYSTEM.

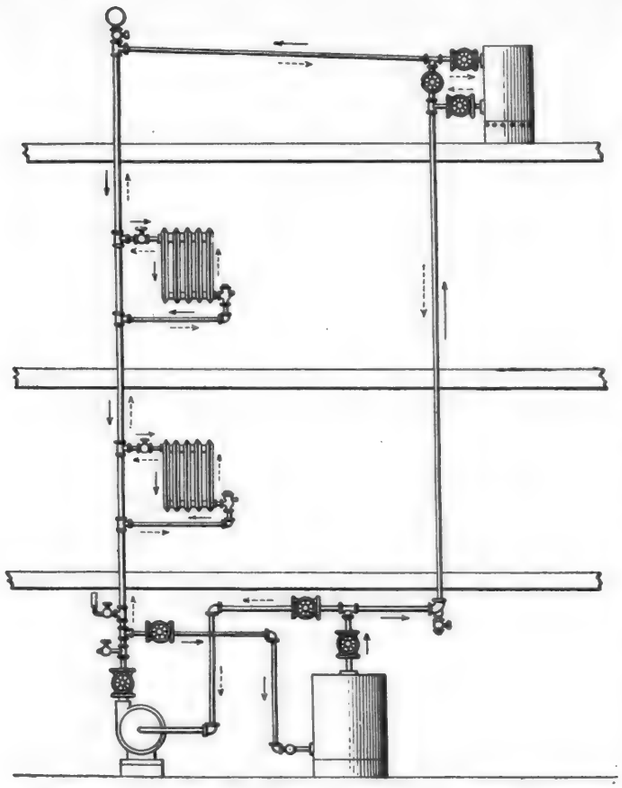


FIG. 5—ARRANGEMENT OF COMBINED SYSTEM WITH COOLING EQUIPMENT IN ATTIC.

for cooling. Pans are shown beneath the radiators to catch any moisture that may drip from the cool radiator surfaces.

If the heating is done by steam, the return ends of the radiators will need to have a special check which would be kept open during the summer to allow the free circulation of the cold water. A patent has been granted to Mr. Feldman on his scheme.

Points on Smoke Pipes and Chimney Flues.

A simple way to determine whether a chimney flue has a proper draft and is capable of performing satisfactory work is to light free-burning paper in the flue. If the paper drops to the floor instead of going up and out of the chimney, it is needless to say that there is a defect somewhere.

One mistake often made in regard to flues is leaving the flue open or hollow to the floor line. Usually the brick work is poor and loose. Consequently, there are a great many air leaks which, of course, kill the draft. A flue should not be left hollow or open more than 12 in. below where the smoke-pipe enters same. It is also bad practice to place cleanout doors lower than 12 in. below the bottom of the smoke-pipe entrance.

Another item is the apparent inconsistency in the sizes of smokepipe listed in manufacturers' catalogues for different sizes of heaters; for instance, the same size smokepipe, namely, 16 in., is listed for a boiler having a rated capacity of 5200 sq. ft., with a grate area of about 18 sq. ft., and a boiler of the same series rated at 10,000 sq. ft. capacity, with a grate area of 38 sq. ft. It is not always wise to use the same size of smoke-pipe on five or six different sizes of heaters. While it is true it would be impossible to change the smoke-pipe opening on every boiler, due to the added cost, still, some reference should be made as to the proper size of smoke-pipe to be used between the heater and the flue, in proportion to grate area and rating. This matter should not be left entirely to the judgment of the contractor or engineer, for the reason that the manufacturers should be best able to state the proper size of smoke-pipe to be used in connection with their own product. E. J. FEBREY *before the heating engineers' society.*

LEGAL DECISIONS

Return on Heating Plant—Not a By-Product.

In approving a new schedule of rates for the Indiana General Service Company, the Indiana Public Service Commission found from the evidence that approximately 8% of the gross revenues of the combined electric and heating utility is realized from the heating service. Counsel representing patrons, insisted that the water heating was originally represented to be a by-product operation connected with the electrical property. While such representation may have been made at the time of the installation of the plant two decades ago, records in this and numerous other cases establish the fact that, under present conditions, such water heating plants cannot be considered as by-product operations.

In certain instances where exceptional service or conditions have warranted it, and under the pressure of increased interest costs, the Indiana Commission has allowed an 8% basis of return. The commission held to the 7% basis of return on the value of a heating plant on taking into consideration (1) That the rate of return allowed on the property is safeguarded to the greatest degree possible under State regulation; (2) that the rate of return is not after the tax burden (except Federal income tax) has been discharged; (3) that a considerable part of the capital which they company has borrowed bears a low interest rate; (4) that there is no showing in the case of extraordinarily efficient service, though there is no complaint as to quality; and (5) that the heating utility is an advantageous adjunct to, though not a by-product operation of a greater utility operation.

Heating Company's Service Stands Commission's Test.

Complaint having been made with the North Dakota Board of Railroad Commissioners of the inadequacy of the steam heat service of the Hughes Electric Company, the Commission made an investigation and survey of the heating system during the early part of the winter of 1919-20. The parties agreed that the slight charges involved in having a steam fitter connect and remove the instruments and gauges required, should be borne by the electric company in case the steam heat was found inadequate, and by the complainant in case it was found adequate. The tests and inspection over a period of six weeks showed that the company was maintaining a pressure, in steam heating service never falling below 1 lb. at the inlet to the coils in the hot water boiler which would naturally indicate that the pressure at the service valve to the building would be somewhat higher than the pressure at the hot water boiler, and since the minimum requirement of a low pressure steam heat system fixed by the Commission's order calls for only 1 pound of steam at the service valve where the steam enters the building of a consumer the test by investigation showed that in the particular instance the service was adequate in that the pressure was properly maintained above, the minimum requirement; and that in other cases inspected, the constant pressure averaged for a continuous period 1.75 lb.

Tapping Steam Heat Service for Live Steam Prohibited as Discrimination.

In considering a complaint from a consumer rearding the amount of a bill rendered him by the Hughes Electric Company for live steam, the North Dakota Commission found after investigation that as many as five consumers of steam heat had tapped their steam services, and connected small pipes ranging from one-eighth to three-fourth inches for the purpose of using live steam. This was being done without the knowledge or approval of the electric company, and amounted to a big discrimination, inasmuch as steam heat service can only be measured and charged for by measuring the condensation through a meter. A utilization of live steam would not permit a return of the condensate through a meter and consequently this service was taken without the payment of a reasonable charge therefor. The commission established and ordered into effect rates based on a unit per hour of use and provided specifically that the present users of live steam should be required to discontinue such use in the short period of a few months within which time the commission planned to issue rules of service for steam heating utilities which would prohibit the tapping of steam heat service for any use of live steam.

CORRESPONDENCE

Uncle Ben's Steel Smoke Pipe in a Warm-Air Heating System.

EDITOR HEATING AND VENTILATING MAGAZINE:

I give Uncle Ben four years for his smoke pipe to rust out and set his house on fire. Cast-iron would be all right; steel never. I tried it. (Page 45, March issue.)

Philadelphia, Pa. J. G.

"I think it is perfectly clear from the body of the article," writes Uncle Ben, "that the smoke-pipe is arranged so that it is inside the brick flue, so that even should a hole rust in it, it is hard to conceive of any flames passing out to set fire to the house. Vertical steel smoke flues, with free air circulation around the outside, have been in use as long as twenty years without rusting through. I have seen many of this type in schoolhouses much more than four years old, and still intact. If this pipe lasts four years, however, Uncle Ben can well afford to replace it and has built it in such a way that he can do so without serious difficulty."

Gas Fuel in the Heating Industry.

EDITOR, HEATING AND VENTILATING MAGAZINE:

We have read with much interest a series of articles by David H. Cuyler appearing recently in THE HEATING AND VENTILATING MAGAZINE under the caption "The Advantages of Gas Fuel in the Heating Industry."

While these articles are of passing interest it is to be regretted that the author did not more thoroughly acquaint himself with the very substantial advances that have been made in the subject during the past few years. Rules for practice are given which do not conform to recognized standards; moreover some statements are made that are at least misleading to the average layman.

In the October issue, under the sub-heading "The Efficiency of Gas-Fired Heating Boilers," the author draws attention to comparative heating value of coal and gas in a way that casts an unfair reflection upon the gas manufacturing company.

He attempts to show on the one hand that the chemistry of coal in its relation to boiler room economy is a matter of common knowledge; that in supplying coal to the trade, the producer aims to sell a product "high in the essential constituents required for fuel purposes." On the other hand he would have you believe that pursuant to common law and under the police power of regulatory bodies the gas company produces and sells a gaseous fuel of the poorest quality allowed under the regulation.

In challenging such a statement attention is directed to the fact that heating value and the other characterisics of gas are in no sense a mystery ,or need it for any reason be a subject of any of the traditions of the secret arts. Fortunately it is just as easy and even a little more so to keep an open-book record of the heating value of gas supplied for fuel purposes as it is for any other fuel.

Generally speaking, the cost of a commodity is regulated by the factors which enter into its production. The cost of coal, therefore, is regulated by the cost or mine, transport and sell it, the high content of essential constituents of coal being contributed by Mother Nature. Therefore, since a coal high in such essential constitutents costs no more to produce than other grades, the advantages accruing to the producer of a high grade coal are obvious.

The cost to produce manufactured gas is an entirely different problem. In this case, the cost to manufacture is in a large measure controlled by the heating value of the gas produced. Previous to the advent of Public Utility Commissions, and standard of practice had not been established relating to heating valve and in the majority of cases the grade of gas made was above standard. Therefore, even under the circumstances of unrestricted regulation and with no competition, manufactured gas met the established standards in all fairness to the consumer.

The author's statement that the gas producer fights "to serve you with the poorest grade of product that he can get away with" is conclusive evidence that he (the author) is not acquainted with the real facts in connection with the present situation regarding regulatory matters and the problems associated with gas manufacture.

In these days of abnormally high prices of coal, oil and labor, gas companies have had to petition for higher rates. Serious thought has been given by the Utility Commission to the subject of a lower B. T. U. gas, since by lowering the B. T. U. content of the gas, less oil is required in its manufacture and therefore, the problem has been and still is to determine the lowest heating value consistent with good practice and the interest of the consumer.

The author's reference to variation in the quality of gas from 500 to 650 B. T. U. in different localities should have at least been supplemented by the statement that these values refer particularly to manufactured gas. There is a very general use of natural gas for house heating.

Reference made to the qualifications required by an engineer to "design a gas burner equipment" seems a little foreign to the subject. It seems needless to remind engineers, particularly those with heating experience, that it is impractical to apply gas burners to boilers which are designed for coal firing, the manner of heat transmission being entirely different in each case. While it is true that burners should be of the proper design, it is more a problem to design the proper type of boiler to absorb to the highest degree the converted heat of the combustion products and thus give the best efficiency.

formance curve of each and every undertaking." This is

The author speaks also of having to know the "true per-

stressing a point of no practical significance—gas-fired boilers for house heating have been in use long enough to demonstrate their reliable performance and high efficiency as boilers. There is no difficulty in securing 85% efficiency and with spe-

cial apparatus it has gone even considerably higher. These boilers require no mysterious theory or trade literature for exploitation. The gas-fired boiler has demonstrated that its operation can be relied upon with great accuracy.

In the December issue, under the sub-heading "Essential Factors of Design," we desire to call attention to the following:

Under "Heater Connections"—the author says that gas pipe should grade towards the heater, and be provided with a drip and drain cock at the heater. Modern practice, however, would require that all horizontal pipe should be graded towards the riser at the meter and the bottom of said riser should be fitted with a T with proper length nipple and cap for the purpose of collecting the condensation.

Under the rules for the "Gas Meter"—it would be better to say, meter shall not be subjected to extreme heat and cold. The thought expressed by the author might be misconstrued and the meter set in a cool place where it might be subjected to freezing temperature.

The table of "Gas Requirements" for various appliances requires one important correction, namely, the amount of gas to be provided for instantaneous water heaters. The author gives 100 cu. ft. each. Such heaters require from 100 to 500 cu. ft. per hour depending upon their size.

New York, N. Y. W. A. E.

REPLY BY DAVID H. CUYLER.

The writer of the above letter speaks with an authority that demands attention. He is an Industrial Fuel Engineer and an active member of the American Gas Association. The writer's ideas and views are simply those of the heating engineer.

In considering the above letter, it would seem advisable to ask further enlightment on several of the subjects mentioned. (1) Mr. Ehlers refers to "rules for practice" conforming "to recognized standards." With no other intention than a search for information, may we ask where such "standards" are to be obtained and by whom or what authority have they been "recognized?"

(2) It being quite evident that the writer's articles were stressing the advantages of gas fuel in comparison with almost any other that we are acquainted with, it is not clear why Mr. Ehlers should bring out so conclusively that gas fuel is at any sort of a disadvantage, other than a temporary one which a change in raw materials conditions will rectify in due time.

(3) The challenge of the writer's statement that "the gas producer fights to serve you with the poorest grade of product that he can get away with" would seem to be touching on a subject that might well lie dormant for the present, but as it has been so challenged we would reflect that there can be only one constituent in a fuel that is of interest to the heating engineer and that is its heating value, or its B. T. U. efficiency. A casual perusal of any of the magazines published in the interests of the gas industry will evidence the fact that there is a widespread demand on the part of this industry for lower and still lower calorific values. In an article by E. J. Blackwell in the January issue of *Gas Record*, he starts off with the unqualified statement that,—"The year 1920 has seen two great interdependent forces in the gas field developing to such an extent as to bid fair to radically change carbonizing methods, (1) the shortage of oil and (2) the call for reduced calorific values." We mention this only as an example of numerous other articles of the same general type.

(4) The heating engineer, in his relation to the gas producing industry, must perforce retain the position of a purchaser. And such being the case, he will continue to advocate in his practice, the adoption of such apparatus or fuels as will prove up best from his standards for economy, efficiency and usefulness. Hence the scarcity or high cost of gas-oil or other materials would seem to be a matter foreign to the subject so far as he is concerned. The interest of the heating engineer lies and must continue to lie, in a rightful decision, whether or not he can afford to advocate the general use of gas fuels for heating purposes. The gas producers' inability to supply this fuel in reasonable competition with other fuels is unfortunate if it be a fact.

(5) A careful study of the writer's articles will reveal a tendency to deal rather with the future of this interesting subject, than with the unsettled present. In the December issue we stated, "The fact of the case is that it is right up to the engineering profession to work out the many problems that offer restrictions, so that these fuels (gas fuels) may be had of a quality and quantity that will insure maximum service at a minimum cost. That is what the future demands of us."

(6) Mr. Ehlers states that "there is no difficulty in securing 85% efficiency" with gas-fired apparatus. Here again we must reflect that the heating engineer is not concerned with laboratory tests, or special performances. What we will have to base a future judgment on is the ability of the gas appliance industry to insure an efficiency of perhaps 90% in ordinary, every-day usage.

Heat Transmission from Radiating Surfaces for Various Steam Pressure and Temperatures.

EDITOR, HEATING AND VENTILATING MAGAZINE:

Will you kindly advise me where I can secure information stating the number of B. T. U. given off by a pipe coil and cast-iron radiation under pressures ranging from 2 to 100 lbs.?

Jeannette, Pa. ELDER.

It has been quite often assumed that a radiator loses about the same amount of heat irrespective of its form or size or condition of operation. It will be seen, however, that these are very wide ranges of heat transmission depending upon the conditions of operation since the heat given off by a radiator depends upon the number of columns in depth and upon its height. As this is in proportion to the difference in temperature between the heating medium in the radiator and the temperature of the air surrounding the radiator, the low radiators give off more heat per square foot since with the high radiator, the air at its top is of a higher temperature and consequently there exists a less difference in temperature inside and outside at the top of the radiator. The hospital type of radiator is usually spaced ½ in. more than the standard type, so the hospital type may be roughly assumed to give off from 7% to 10% more heat than the standard type.

A hot water radiator gives off 150 heat units per square foot per hour, while a steam radiator gives off 250 heat units. These figures are calculated on what is known as standard conditions, a room temperature of 70° F., an assumed average temperature of the water in the radiator of 170°, and with steam at a temperature of 220°, however, they are only general, for the exact amount of heat given off varies with the form of the radiator. For instance, a single-column 22-in. high steam radiator will give off 285 heat units per square foot per hour, while a four-column 45-in. radiator will give off but 210 heat units per hour, a difference of 35%. To secure accurate results the exact type and form of the radiator should be determined, and the efficiency of the particular radiator selected used as the basis for determining the amount of radiation required. But, for general purposes, 250 heat units per square foot per hour for direct castiron low-pressure steam radiation may be safely used, except in the case of radiators of more than two columns in depth and more than 38 in. in height.

The efficiency of direct radiator surfaces is also modified by the difference in temperature between the inside and outside of the radiator, as previously stated, so that if the steam pressure or temperature remains the same but the room temperature differs, the assumed efficiency of the radiating surface should be modified accordingly.

As given by C. A. Fuller in his book entitled "Designing Heating and Ventilating Systems," the rate of transmission is found to vary approximately 2% for each 10° variation from the standard conditions of 150° temperature difference. If the difference is less than 150°, the transmission will be less per degree difference than the above values, and if the difference is more than 150°, transmission will be higher.

Assume, for illustration, a room temperature of 60° and a steam temperature of 230° which gives a temperature difference of 170°. This is 20° more than the standard conditions of 150°, and allowing 2% for each 10° variation, the values must be increased 4%. Assuming a two-column radiator 32 in. high, the factor is 1.71.

1.71 x 0.04 = 0.068

1.71 + 0.068 = 1.778 B. T. U. per degree difference.

1.778 x 170 = 302 B. T. U. per square foot per hour.

Table No. 1 is taken from Mr. Fuller's book and gives the total B. T. U. transmitted per square foot per hour for various types of radiation when the temperature difference is standard, that is, 150°.

TABLE I—HEAT TRANSMITTED BY VARIOUS TYPES OF RADIATION.

Type of Radiator	Height of Radiator 22 in.	26 in.	32 in.	38 in.
1 col.	285	279	275	270
2 col.	270	263	257	250
3 col.	255	248	240	231
4 col.	240	233	225	218
Window Radiator			277	
Wall Radiator (horizontal)			293	
Wall Radiator (vertical)			285	
Pipe Coils			300	

For a more exhaustive review of this subject, the correspondent is referred to a paper on "Heat Losses From Direct Radiation," presented by J. R. Allen at the Annual Meeting of the American Society of Heating and Ventilating Engineers, New York, January, 1920, and reprinted in THE HEATING AND VENTILATING MAGAZINE for March, 1920.

CHATS WITH UNCLE BEN

Foul-Air Outlets and Fresh-Air Inlets.

Uncle Ben was sore. He said he had no use for these hide-bound people who wouldn't read, or, reading, wouldn't remember and learn. He said he had seen an article by a school superintendent telling about how the heavy foul air settled to the floor. The old fellow waxed quite indignant over a claim made in the article that the carbon dioxide was the thing in the air that should be removed.

"Why," said he "those who know have been writing and telling for years that carbon dioxide in the quantities present in expired air, hurts no one. Did you ever think how your lungs are like one of these little squirt syringes you can hold in your hand having a rubber tube and a bulb that you squeeze? You squeeze the bulb and can draw water up the tube, as you release the bulb, the water being forced up into the reduced-pressure-space by the atmospheric pressure. Then you squeeze the bulb and you can squirt some of the water out, but not all of it—no, my boy, never all of it. You can repeat the process over and over, and each time you have the tube full of water even though the bulb is empty. Next time you fill up, the water in the tube comes back into the bulb.

"Well, our lungs are like the bulb and our tubes are the throat and nasal passages, much larger in proportion to the lung capacity than the rubber tube is in relation to the bulb. Cold, fresh, uncontaminated air never does enter the lungs. It is always warmed by mixing with that in the tubes, and you may say contaminated by it, if such a thing can happen. Why, the medical sharks claim no evidence exists that any infection can be carried by air at all. They say it has to be carried by dust or drops of moisture swept along with the air. They say, also, that our air-ways are lined with a very special anti-bug lining and coating that will resist to a wonderful extent any infection carried by droplets or dust, in any event; otherwise, living in a fog of bacteria as we do, none of us would survive. Nature seems to have arranged for the air which reaches our insides, to have been warmed and cleaned and possibly somewhat conditioned in other ways by the peculiar and particular pipe connections with our outsides.

"They claim and have proved over and over that breathed air dilutes forever with fresh air, and, as far as I can see, what makes any air settle toward the floor in an ordinary heated room is difference in temperature, and nothing else. Outside air, on being invited or forced in, falls to the floor if it's colder than the air in the room, and rises to the ceiling if it's warmer than the air in the room. People in rooms, who have been there some time can't detect one kind of air from another by any of their senses, except that of temperature. When people faint because of 'bad air,' it's because of hot air; and by hot, I don't mean just some degree of heat but some degree of heat combined with some degree of moisture. Heat and moisture as applied to air can't be considered as separate, as far as people are concerned. Come to think about it, I guess all animals are the same way. I guess that when the sharks know more about it a conclusion will be reached something like this: chemical condition of air breathed cuts out of 100% of ice about 5%, and temperature and moisture condition of the air wiped over the body cuts about 95% of the ice.

"You and I have all our good, old, tough hides to act as temperature-controlling surface. If you don't believe it's effective, lick the back of your hand and then blow on the spot. Our organization is so fine that they claim we'd die of inability to control our temperature if half of our skin was lost. There is a classic story about the tragic and sudden death of the side-show lady whose body was entirely coated with gold-leaf. Also we often wonder how the Indians in the northern parts of our country ever got by in winter with the scanty attire dictated by the Dame Fashion of that period. What he did was to lubricate his hide with bear grease producing the two-fold result that he began to feel warmer immediately and very soon became an unpleasant Indian to live with.

"Think of a poor dog—he doesn't have heat-regulating skin surface except on his nose and tongue. No wonder the poor fellow pants. That makes me think of the story about why the dog's nose is always cold. They say in Noah's day the dog was the helper and the friend of Noah, just as he has been man's friend ever since. He helped the grand old sailor-man drive all the other animals on board the day of the big rain, and so, of course, and as usual, was the last party on board. Noah had to calculate on a big crowd and, of course, cut it as fine as he could. The dog squeezed and he squeezed, and got in all right so that they could shut the door almost tight, but he couldn't, just couldn't get his nose in. All through the voyage, therefore, the poor little dog's nose was out in the cold and got so chilled it never did get warm since."

When I put foul-air outlets, etc., at the front of this yarn, I know you saw chimneys and windows. Yet, if noses and wind-pipes are not the same thing, I'd like to know what they are.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

The New President of the Heating Engineers' Society.

CHAMPLAIN L. RILEY.

In presenting this new portrait of President Champlain L. Riley, we requested Mr. Riley to give us an account of his career, for publication in connection with the portrait. In his response he sends a message to the profession which we are very glad to publish.

"I have had only one job in my life," he writes, "as I have been for nearly twenty years in the employ of Clark, MacMullen and Riley, and my experience has been identical with that organization. There is a word, however, in regard to the American Society of Heating and Ventilating Engineers which I would like to say through your columns.

"The number of chapters of this society and the membership in each has been growing rapidly. It is our aim to utilize the meetings of the chapters in all parts of the country by arranging similar programs so that the same subjects will be treated simultaneously and the resulting papers will be available for use in the *Journal*. Thus we will have, for part of the meetings, at least, a program outlined by the National Publication Committee, which committee will offer suggestions and advice to the chapters so that their work will co-ordinate, thus bringing the chapters closer together and making the papers prepared for each, available for all.

"The American Society of Heating and Ventilating Engineers has many of the aims of an educational institution and, with a properly-developed program, can become a College of Heating and Ventilating. The development of this picture may take many years, but the agencies are already at work and we may look forward with confidence to increasing co-operation between chapters."

CHAMPLAIN L. RILEY.

Planning for School Test at St. Louis.

The St. Louis Chapter held its regular monthly meeting at the American Annex Hotel on March 10. This was scheduled to be a test meeting at the Buder School but due to the fact that some of the apparatus was not ready the test meeting was postponed until April. A membership drive is to start soon in this chapter and at the March meeting were read names of twelve applicants for membership.

Dean Scipio spoke regarding the subjects upon which the Research Laboratory is now working and illustrated his talk with lantern slides. The Dean has recently been appointed a member of the National Research Committee of the United States.

E. S. Hallett then asked for the appointment of a committee to take charge of a test which he had promised Dean Scipio should be run in one of the St. Louis schools at 65° F. and at a relative humidity of 40 to 50%. Mr. Hallett was appointed a committee of one for this purpose.

Discussion on Heating and Ventilating of Schools.

The monthly meeting of the Western New York Chapter held at the Hotel Iroquois, Buffalo, N. Y. on March 7, was devoted to a discussion of the proposed heating and ventilating equipment for the intermediate school program in that city. In order to cover the most ground in the available time, subjects were assigned to several speakers as follows: "Basis of Design," L. A. Harding; "Heat Losses and Direct Radiation," L. A. Cherry; "Ventilation Requirements," R. T. Coe; "Hot Blast Equipment," O. K. Dyer; "Air Washer Equipment," H. Worsham; "High Pressure Boilers," H. C. Beman, "Low Pressure Boilers," Hugo Hutzel; "Specifications and Contracts," Loring Danforth. Each speaker was allowed ten minutes for the presentation of his paper, discussion was limited to the same period, and at the end the whole subject was summarized by the president. The program provided about three hours of concentrated heating and ventilating information. At the end of the meeting the following resolution was adopted:

"Resolved: That the Society of Heating and Ventilating Engineers appoint a committee to interview the Board of Education and request them to appoint an inspector to see that the heating and ventilating plants in our public schools are operated under the conditions for which they were designed."

"Refrigeration and Its Application to Heating and Ventilation" Discussed by the Illinois Chapter.

On March 14 at the Chicago Engineers' Club was held the regular monthly meeting of the Illinois Chapter. A committee was appointed to wait upon Senator Carlson and offer the cooperation of the chapter in the framing of a Ventilation Bill for which the senator is sponsor.

The president then announced the subject of the evening, "Refrigeration and its Application to Heating and Ventilating," and turned the meeting over to the committee in charge, W. J. Mauer, chairman, R. A. Widdicombe and Homer R. Linn.

The first speaker was Lewis Lipman, of the American Radiator Company, who discussed the various systems of refrigeration in general and in particular, discussed a grid type of expansion and condensing member with which he has been experimenting for several years past. Following

Mr. Lipman's paper, Arnold H. Goelz, Vice-President of Kroeshell Bros. Ice Machine Company, discussed compression systems, using carbon dioxide gas as a refrigerant. His remarks were accompanied by lantern slides, showing various sizes and arrangements of this sort of equipment.

The next speaker was Harry Sloan, Advisory Engineer, Vilter Manufacturing Company, Milwaukee, Wis., who described compression systems, using anhydrous ammonia as a refrigerant and showed many interesting slides covering this subject. Mr. Wittenmeier gave some very interesting experiences along the lines of air cooling and H. C. Gardner made some remarks regarding the use of direct expansion ammonia in cold storage work, versus carbon dioxide.

New York Chapter Discusses Latest Developments in Air Conditioning.

Valuable test results on the resistance through air filter screens, and important data on the use of radiant heat in air conditioning work, were among the principal points brought out at the March meeting of the New York Chapter of the heating engineers society, which was held at the Building Trades Club, New York, March 21. J. Irvine Lyle was the chairman for the evening and he introduced the subject by showing a number of slides, illustrating the application of air conditioning to various industral processes, such as cotton cloth manufacture, tobacco curing, bread making, and candy making. He said there were no less than 100 well-known products in the manufacture of which air conditioning can be successfully applied.

He then introduced A. E. Stacey, who told of the experiments conducted at the laboratory of the Carrier Engineering Corporation on the resistance through filter screens. His talk was also illustrated by lantern slides, showing the apparatus as set up and the various kinds of screens tested, including those made of cotton, wool and Chinese silk. Curves were included for each type. One of the things found out was that the relative humidity of the air has no effect on its passage through the filters. In response to a question as to the comparative merits of cloth and water filters, he stated that it is not possible to remove carbon particles with water filters. He showed that wool filters are better than cotton. The common form of cheese cloth air filters was condemned as of little, if any use. The results of the experiments will be published later.

The third speaker, A. W. Lissauer, of W. L. Fleisher & Co., presented a thoughtful paper on "Drying as an Air Conditioning Problem." He reviewed at length the fundamentals involved and concluded with an account of the results that had been obtained through the application of radiant heat, especially to the drying of thick substances where the danger of case-hardening was a factor.

This portion of his paper led to a discussion later as to the difference between using radiant heat and convected heat for such purposes, Burt S. Harrison taking the position that with a proper dew-point of the circulating air so as to prevent evaporation for the time being from the substance to be dried, the convected heat would be just as efficient as radiant heat in heating up the material.

Previous to taking up the main subject for the evening, President Walter L. Fleisher called on C. V. Haynes, who has been appointed chairman of the society's membership committee, to tell of the plans for increasing the membership of all the chapters.

Champlain L. Riley, chairman of the nominating committee for the chapter, presented the following ticket which will be sent out for letter ballot: For president, A. S. Armagnac; for vice-president, Willis H. Carrier; for secretary, J. E. Bolling; for treasurer, William J. Olvany; for members of the board of governors (three to be elected): G. A. Dornheim, R. A. Wolff, B. K. Strader, W. L. Durand, W. L. Fleisher, A. A. Adler and A. A. Kiewitz.

Ventilation of the New York-New Jersey Vehicular Tunnel.

In the account published in THE HEATING AND VENTILATING MAGAZINE for January, 1921, of the discussion before the New York Chapter of the heating engineers' society, on the ventilation of the New York-New Jersey vehicular tunnel, C. M. Holland, chief engineer for the tunnel commission was quoted as having said that even with the elaborate system of ventilation figured on for the tunnel, the proportion of carbon monoxide would run up to 10 parts in 10,000. We are advised by Mr. Holland that this should read "four parts in 10,000."

The report continues: "It is anticipated that on this basis the air supply will average 1,750,000 cu. ft. per minute." This figure, Mr. Holland points out, is for each of the two tubes.

The report also stated: "Another question brought out the fact that the distribution system of ventilation can be accomplished with 20% less air than the blow-through system." Mr. Holland's statement on this point was that in order to dilute the air to give the same physiological effects, less air would be required by the blow-through system than the distribution system.

As a matter of fact, however, the blow-through system would mean an air velocity of over 30 miles per hour through the tunnel, and for this and other reasons the distribution method was decided upon, in which the fresh air is carried in a duct underneath the roadway and admitted through openings at that level, and the exhaust air removed at the top of the tunnel.

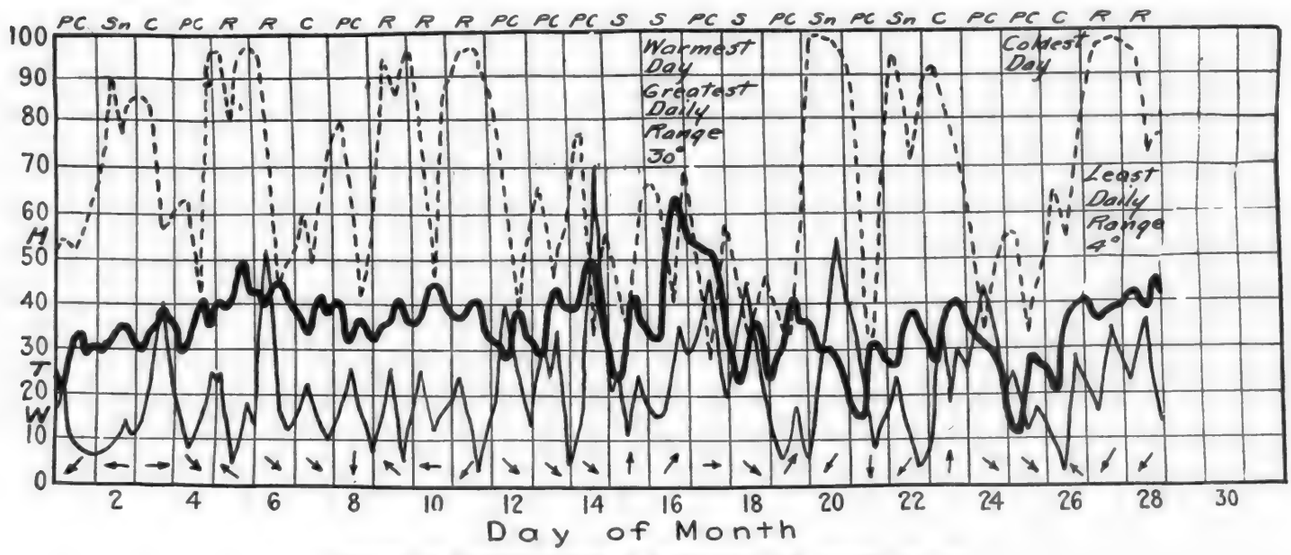
Announcement has been made that Professor A. C. Willard of the University of Illinois, has been retained as consulting ventilating engineer by the tunnel commission, succeeding the late Dr. John R. Allen.

Customer Bound by New Approved Schedule of Rates for Steam Notwithstanding Contract.

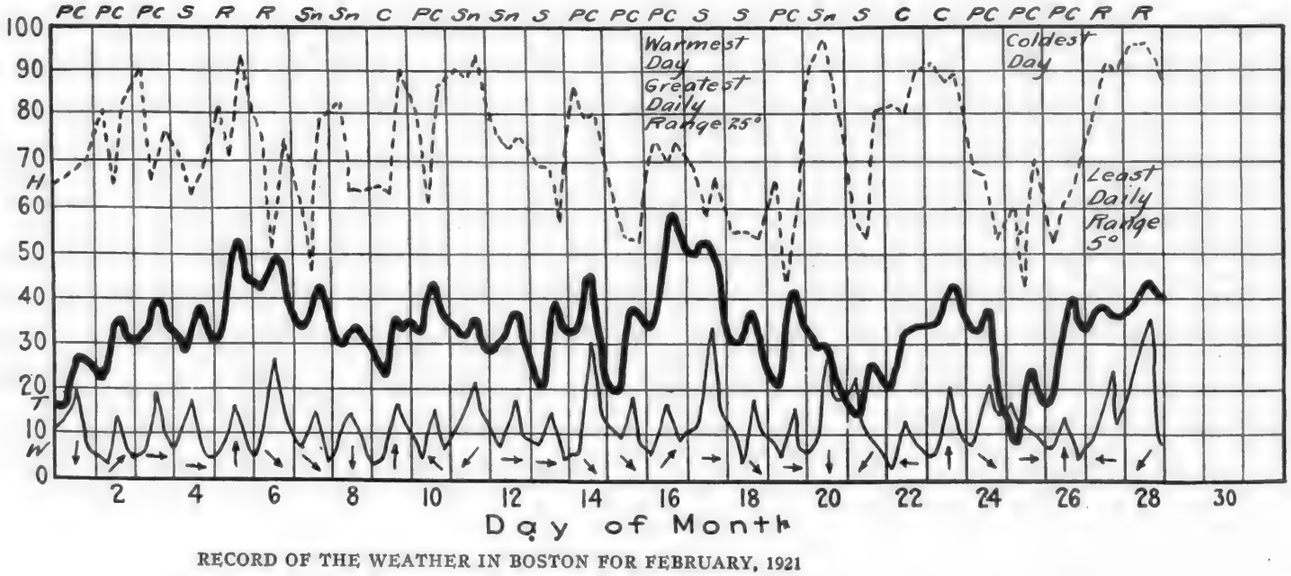
The New York Steam Company made a contract for the supply of steam to a building in New York for a period of 5 years from October 1, 1916, at a rate therein specified. At that time the company, occupying the public streets, was placed under the supervision of the Public Service Commission. Some time after the making of the contract, the company filed new schedules which increased the rate beyond that fixed by the contract. The owner of the building refused to pay the increased rate. A controversy was submitted to the New York Appellate Division, the owner contending that the filing of the increased rate impaired the obligations of his contract. The court held, however, that if at the time the contract was made the company was deemed by the Legislature to be a public service corporation, and was accorded the rights of such a corporation to lay its pipes in the public streets, the contract must have been made in view of its powers and obligations. One of those obligations was to furnish steam to all applicants at a uniform rate. If this contract rate must hold, the company was not furnishing steam at a uniform rate, and it was without power to make a contract which would preclude it from complying with the law to make a uniform rate. The schedule as filed was subject to the supervision of the commission as to its fairness. If the contract contained the implied condition that the company might change its rates to conform to the reasonable expense of the furnishing of the steam, the consumer is bound by the new schedule filed and approved by the commission, and the company receivers could recover the rate according to the new schedule.—Fitts v. Andrews, 192 N. Y. App. Div. 160, 182 N. Y. Supp. 464.

THE WEATHER FOR FEBRUARY, 1921

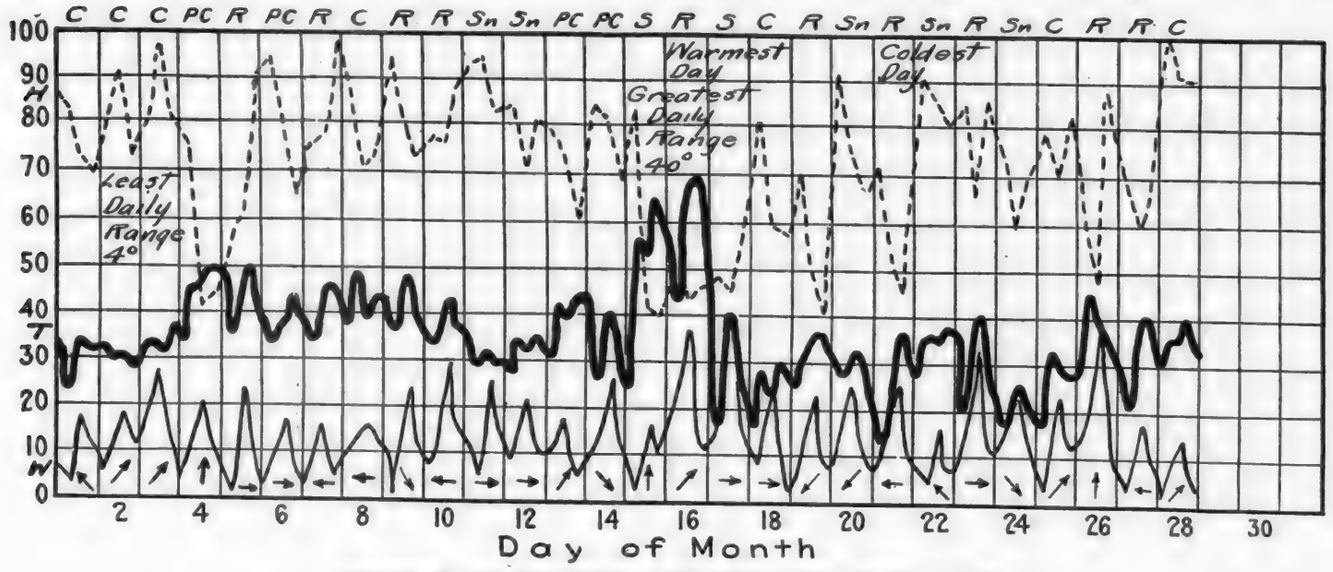
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	63°	59°	70°	66°	73°
Date of highest temperature	16	16	16	15	15
Lowest temperature, degrees F.	11	8	14	17	23
Date of lowest temperature	25	25	21	17	20
Greatest daily range, degrees F.	30	25	40	32	33
Date of greatest daily range	16	16	15	16	28
Least daily range, degrees F.	4	5	4	4	4
Date of least daily range	27	27	2	10	1
Mean temp. for month, degrees F.	34.8	32.5	35.6	33.4	42.1
Normal mean temp. for month, deg. F.	30.7	28.0	31.8	25.4	34.5
Total rainfall, in.	4.90	2.64	1.80	0.38	1.08
Total snowfall, in.	13.5	23.2	5.4	10.1	none
Normal precipitation, this month, in.	3.74	3.44	2.66	2.16	2.75
Total wind movement, miles	11977.	6950	8093	8535	8593
Prevailing direction of wind	N. W.	W.	S. W.	W.	N. W.
Number of clear days	3	5	2	3	10
Number of partly cloudy days	11	11	4	8	8
Number of days on which rain fell	10	8	13	6	7
Number of days on which snow fell	3	5	5	3	none
Snow on ground at end of month, in.	none	1.0	none	none	none



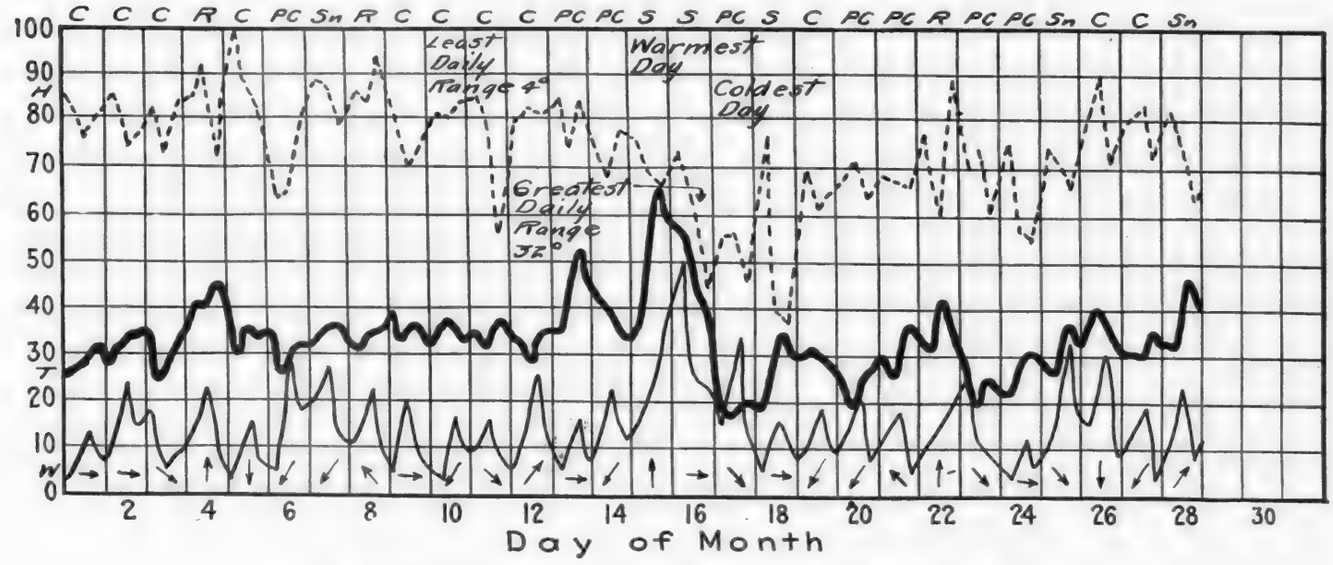
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1921.
(Hourly Observations of Relative Humidity Plotted on this Chart.)



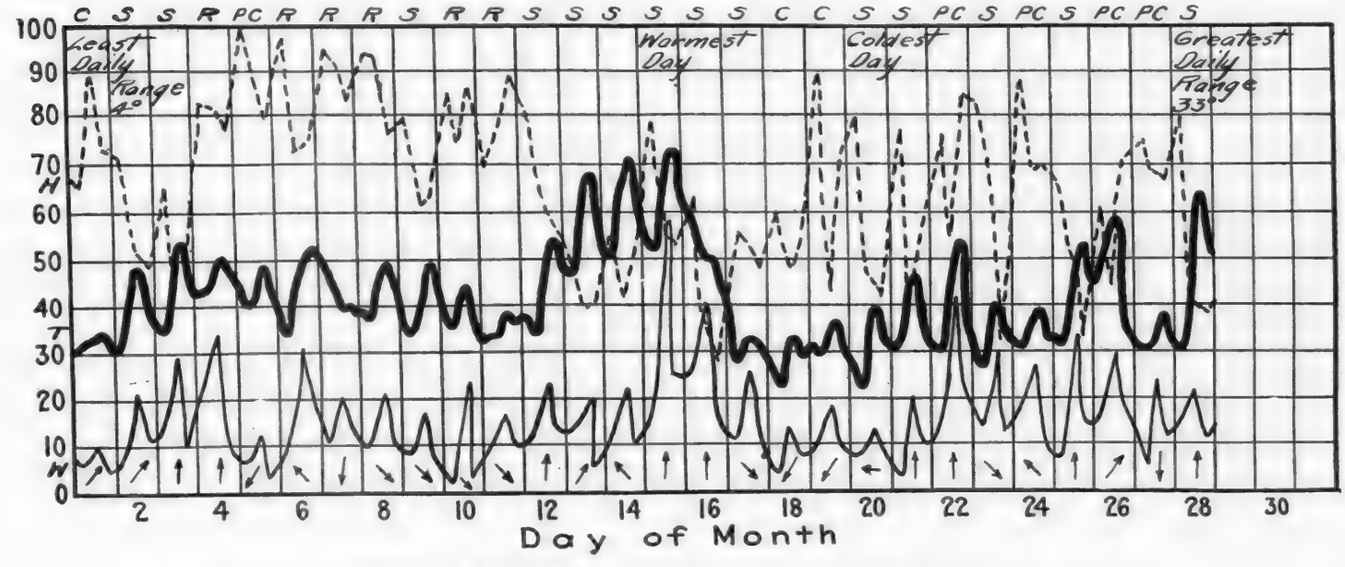
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1921



RECORD OF THE WEATHER IN PITTSBURGH FOR FEBRUARY, 1921.



RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1921.



RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1921.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United State Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly claudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

How to Make Tests of Air Leakage in Buildings.

It will soon be possible to determine, through the use of infiltration factors, the exact amount of radiation that must be allowed for inleakage of air through the various constructions, and also to determine the quantities of outdoor air available in naturally-ventilated rooms. This is the conclusion reached in a progress report presented by O. W. Armspach before the American Society of Heating and Ventilating Engineers on tests that are being carried out at the Research Laboratory of the heating engineers' society. The progress report, which was entitled, "A Study of the Infiltration of Air in Buildings," took up the apparatus needed to conduct the tests, the methods to be used, and the formulas and calculations as well as data, obtained in the preliminary experiments.

The tests made so far in this investigation have been confined to a room in the Bureau of Mines building in Pittsburgh. The next step will be a complete study covering a large number of existing buildings, so that the coefficients finally derived will apply to the types of construction found in every-day practice.

Some of the things already found out are that natural interchange of air by leakage from outdoors is due largely to the wind pressure on the outside surface. This interchange is maximum when the wind velocity is maximum and perpendicular to the surface and minimum when the wind velocity is minimum and parallel to the surface. Another thing brought out in the preliminary tests is that the quantity of air entering a room does not vary directly with the wind velocity, but as the wind velocity increases, the leakage proportionately decreases. One reason for this is that as the wind pressure increases, the window is forced tighter against its "seat."

METHOD OF DETERMINING AIR CHANGE.

In determining the leakage factors for various constructions, the total quantity of air was considered to be composed of two components, the air leakage per square foot of exposed wall surface, and the quantity of air leakage per linear foot of window crack. It is proposed to determine both of these quantities for various constructions and wind velocities in the tests to follow.

To make the tests, carbon dioxide gas is generated in a room until there will be about 20 parts of CO_2 per 10,000 parts of air. Air samples are then taken every hour for four hours and an analysis for CO_2 made with the Peterson-Palmquist gas-analysis machine. The wind velocities are determined by taking five hourly anemometer readings outdoors, each reading extending over a period of ten minutes. The readings are converted from feet per minute to miles per hour. They are taken at a point opposite the room to be tested and at a sufficient distance away.

METHOD OF CONDUCTING TESTS.

The CO_2 content inside the room tested was brought to the desired point by adding a calculated quantity of sulphuric acid to a determined quantity of sodium bicarbonate. A union of the two compounds produces CO_2 gas. The gas was liberated at intervals at four different points in the room and 30 minutes allowed for diffusion. The amount needed for any sized room may be found by the equation:

$$CO_2 = \frac{C \times R}{10{,}000}$$

in which C = cubic contents of room.

R = parts of CO per 10,000.

CO_2 = cubic feet of gas that must be added to bring the room to the required content.

After 30 min. had elapsed, four air samples were taken at points 4½ ft. from the floor near the corners of the room and also four directly above these, 9 ft. from the floor. Eight samples were obtained in this manner at the beginning and end of each hour for a period of four hours, so that in all forty samples were obtained. Two analyses were made of each sample, making a total of 80 analyses for each test.

FORMULA FOR DETERMINING AIR QUANTITIES.

After the average drop in the CO_2 content was obtained during an hour, due to dilution with outdoor air, the quantity of air infiltrated was determined by the following formula:

$$Q_1 = \frac{2C\,[(CO_2)_4 - (CO_2)_5] + 20{,}000 \times S}{(CO_2)_5 + (CO_1)_4 - 2(CO_2)_1}$$

in which

S = total cu. ft. CO_2 from any source in room;

S = $0.6 \times n$ (n = number of occupants);

$(CO_2)_1$ = CO_2 in outside air, parts per 10,000;

$(CO_2)_4$ = CO_2 in room at beginning of hour, parts per 10,000;

$(CO_2)_5$ = CO_2 in room at end of hour, parts per 10,000;

Q_1 = cu. ft. air entering per hour;

C = cu. ft. of room capacity.

RESULTS OF PRELIMINARY TESTS.

In the preliminary tests, made in accordance with the methods here described, the room selected was on the second floor of the Bureau of Mines building. It had a cubic contents of 4178 cu. ft., including a deduction for space occupied by furniture. The room is about 14 ft. 6 in. x 13 ft. 8 in. The exterior wall is 18 in. thick, built of brick, plastered on the inside. The windows are the sliding-sash type and all sliding portions are fitted with metal weather strips. The exterior wall includes 102 sq. ft. of wall surface, 96 sq. ft. window surface and 46 ft. 1 in. of window crack. The room has three doors, one on either side leading to the adjacent offices and one in the wall opposite the window leading to the corridor. Above the latter is a 42-in. x 18-in. hinged transom. There are sufficient cracks around the doors and transom to permit air to leave the room as it is forced out by air leaking in through the exterior wall. The construction would be considered very tight and of the best workmanship.

A summary of the results obtained showed the following, by which it will be seen that the average air infiltration was 2577 cu. ft. per hour, or 55.8 cu. ft. per hour per foot of crack, with an average wind velocity of 3.37 miles per hour and with a wind direction of 30° (that is, the angle the direction of the wind makes with the wall surface):

Time	Wind Vel., miles per hr.	CO_2 drop	Cu. ft. air entering
9:45 to 10:45	3.15	4.561	2491
10:45 to 11:45	3.33	2.548	2560
11:45 to 12:45	3.55	1.530	2766
12:45 to 1:45	3.65	0.591	2491
Average	3.37		2577

Increase in Rates to Provide for Depreciation and Fair Return.

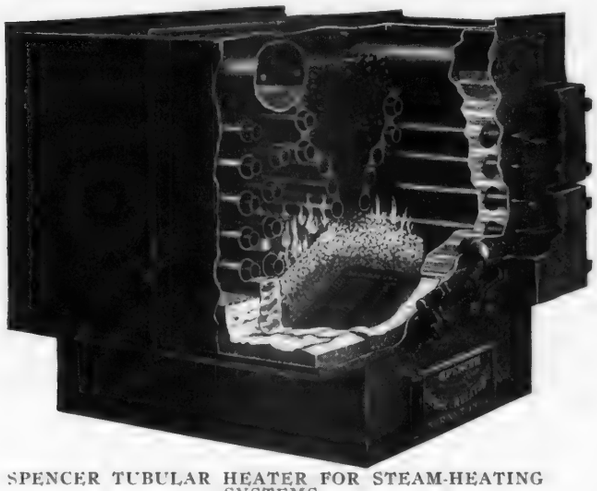
After considering a complaint as to the rates and service of the Hughes Electric Company, a combined electric and steam-heating utility, the North Dakota Commission made an allowance for depreciation at the rate of 4% on the electric property and 4½% on the steam heat property, and allowed an 8% return on the present fair value of the property. The commission increased the rates for electric and steam heat service so as to cover legitimate operating expenses, the necessary fixed charges, comprising insurance, workmen's compensation, taxes and reasonable and adequate depreciation, together with assuring a return of 8% on the fair value.

PRESENT STATE OF THE ART IN SMOKELESS BOILER CONSTRUCTION

No. 26—Spencer Magazine-Feed Heaters.

Spencer magazine feed heaters are made in two types, tubular and cast-iron sectional. The tubular type heaters are made for the steam and vapor heating, while the cast-iron sectional heaters are made for water, vapor and steam heating. same principle as the Spencer tubular heaters, except that the sectional heaters consist of a number of cast-iron sections which are assembled on the base, side by side, and form the flue ways for the heated gases to pass through, each section forming a complete heater in itself. These sections are connected with large nipples making a perfect circulation of both steam and water in them.

The Spencer magazine feed heater is especially designed for burning anthracite No. 1 buckwheat, lignites, or non-coking bituminous coal. With a magazine as a coal reservoir and the sloping grates, the heater will operate successfully burning the small sizes of anthracite coal when connected to a chimney flue of ordinary draft. Both types of these heaters are manufactured by the Standard Heater Company, of Williamsport, Pa.



SPENCER TUBULAR HEATER FOR STEAM-HEATING SYSTEMS.

SPENCER SECTIONAL HEATER FOR WATER OR STEAM HEATING SERVICE.

Both types of heaters are designed with water jacketed magazine feed with sloping grates. The Spencer grates are inclined at an angle of about 45°. As the coal feeds down from the magazine, it is evenly distributed over the whole grate surface, automatically.

The design of the grates permits more ash and clinker to be shaken out at the lower side of the fire, or farthest from the apex of the grate, where the greatest amount of ash accumulates. The center bar which supports the grates are water cooled. In the larger size Spencer heaters the grates are so designed that they can be shaken in sections, as follows: right side, left side, front or back.

The tubular heaters consist of two or three sections of the fire and water-tube type using a 3-in. fire tube through the center of a 4-in. water tube. The tubes are expanded into a steel constructed header stay bolted in accordance with the A. S. M. E. standard. Each section contains a large steam dome located on the water line for steam space. When the two or three sections are placed on the base and grates, they form the coal magazine directly over the center of the apex of the grates of such capacity to supply the heater for twelve to twenty-four hours. The heating surface is so designed that the circulation of water is through the 4-in. water tubes, this giving a perfect and free circulation in one direction. The large steam dome near the water line surface has space for separating the steam from the water and allows for ample steam space.

Spencer magazine feed cast iron sectional heaters are designed along the

Controlling Factors in Smokeless Boiler Design

By DAVID DARRIN.

In the design of low-pressure heating boilers for smokeless operation there are several factors which exert a controlling influence. Assuming that he is backed by adequate manufacturing facilities, the designer must consider the following practical elements:

Available fuel.
  Combustion characteristics.
  Sizes.
Available natural draft.
  Force.
  Reliability.
Available attendance.
  Skill of operator.
  Frequency of attendance.
Available space for the installation.
  Height.
  Width.
  Length.
  Position relative to stack.
Character of service.
  Steam heating system.
  Water heating system.
Heating capacity required.
  Direct radiation.
  Piping losses.
  Stack losses.
  Grate losses.
  Slack periods.
Upper limit of first cost allowable.
  Material costs.
  Labor costs.
  Cost of transportation.
Allowable limit of operating cost.
  Fuel cost.
  Cost of attendance.
  Cost of repairs.
Technical information available.
Patent rights of other manufacturers.

Let us see, in a general way, how these various items affect the design problem. The fuel possibilities in this country embrace gas, oil, wood, coke, anthracite coal, and the various grades of bituminous coal, including lignite. There is a steady increase in the use of gas fuel for heating purposes, but the movement has not yet reached proportions that warrant special attention in this article. Oil fuel stands at present in much the same position, and present uncertainty as to the extent of the nation's oil resources has a bearing on the use of this fuel. Wood and coke are but little used for the service in question.

Anthracite coal has a natural smokeless-operating characteristic which has made it ideal in the past as a fuel under heating boilers. But the end of the nation's known anthracite resources is already in plain sight and the price of that fuel is rapidly receding beyond the limits of unassisted vision, so the future heating boiler must be one that will operate smokelessly on bituminous fuels whose natural tendency is to-

ward a very smoky combustion characteristic, due to a high percentage of volatile contents. The designer of a smokeless boiler must count on the use of bituminous coal as fuel, and must prepare for it.

CONTINUOUS DRAFT A PRIMARY ESSENTIAL.

Another characteristic of this fuel, is its tendency to cake during operation—that is, the burning pieces of coal weld together and tend to choke off the draft. Continuous draft is a primary essential to smokeless operation, so this tendency to cake must be overcome in one way or another. Finally, the size of the fuel has an important bearing on the design problem in this way, that the smaller sizes give much more rapid combustion, due to the greater coal area they expose, and require, therefore, a much stronger draft than do the larger sizes. Also fuel loss through the grate is considerably higher with small sizes than with large sizes, even with a grate especially designed for small-sized coal. The advantage of the small sizes is that they cost much less than the large. The designer must balance these features in determining on his grate design.

AVAILABLE NATURAL DRAFT.

Next comes the question of available natural draft. The designer is interested in both the force of this draft and its reliability. These are determined by the height, location, and structural features of the stack or chimney, and by the relation between the average outdoor temperature and the proposed stack temperature. The draft intensity, or force, increases with the height of stack and with the difference between flue-gas and external air temperatures. Increase of wind velocity also increases the draft force, but this is not an effect upon which the designer can rely. The chimney should extend well above all adjacent objects, otherwise there is likelihood, under certain wind conditions, of a down-draft tendency which will reduce, or possibly even destroy temporarily, the up-draft in the stack. All leakage, either into the stack on the windward side or out of the stack at any point below the top, will also serve to reduce the force of the draft. The boiler designer has a large legitimate interest in stack design.

THE ITEM OF BOILER ATTENDANCE.

A certain amount of attendance is essential to the successful operation of any coal-burning heating boiler. The designer of this class of boiler has to consider both the skill of the operator and the frequency of attendance and then make his design conform to these practical conditions. Coal-passing does not rank very high among the professions but there is, nevertheless, considerable art and science in getting the most out of a boiler. There is a right amount of feed for each stoking, a right placing of the added fuel, a right regulation of drafts and dampers, a right maintenance of water level, a right pressure control, and a lot of other minute but right elements in the process. Many people of superior mentality lack the knack of these things. Automatic regulating devices solve the difficulty in a measure. Gravity feed, combined with a fuel magazine, serves to provide for the condition where the boiler receives attention only at relatively long intervals. Somewhat the same effect is obtained by the use of the down-draft, water-tube grate arrangement invented by Hawley. There is no adequate automatic solution for the caking evil incidental to some fuels. The only real remedy for this is an occasional slicing of the cake in the good old-fashioned manual way to reopen the draft passages which have been "frozen" shut by the burning of the fuel.

AVAILABLE SPACE FOR BOILER OF PRIMARY INTEREST.

The available space for a boiler installation is of primary interest to the designer. Because hot gases tend naturally to rise, the draft required for a given volume of gas is least when there is least opposition to this tendency in the path of the gas. The ideal boiler, from this viewpoint, would be short and narrow and would gain the required volume by extending to a considerable height. Practical conditions dictate, however, a strict limit to the allowable boiler height and usually to the width as well, so that the differences in capacity usually result in differences in length of boiler. The setting of the boiler relative to the stack also has some bearing on boiler design, since it is desirable to have the breeching as short as possible. Usually the boiler is designed with the breeching connection at the rear, but some have this at the front, and a few boilers have it at the side.

The question of whether the boiler is to be used on a steam or a water heating system is one that the designer will wish to know. In general both the temperatures and the pressures are higher in a steam heating system than in one for water heating. This implies differences in both construction and operation of the boiler. The piping connections and storage requirements are also different for these two classes of service. Where a boiler is to be used on either steam or water systems, according to the desires of the purchaser, the designer must make provision for such choice.

REQUIRED HEATING CAPACITY OF BOILER A DIFFICULT PROBLEM.

A peculiarly difficult problem for the designer is to determine the heating capacity which will be required of his design. There is considerable variation in each of the factors which combine to produce this requirement. Direct radiation depends entirely upon the size of the installation. Piping and stack losses depend also upon structural conditions peculiar to each installation, and upon operating conditions which are inevitably subject to considerable variation in each installation. Grate losses are more under the designer's control, providing the fuel used conforms to his specifications for his design. The desire to operate the boiler at low capacity during certain periods, has also to be considered by the designer.

In general, there is one capacity for every boiler at which it will operate most efficiently. This is determined by the grate design and area, the character and size of fuel used, the kind and frequency of attendance, the combined areas of direct and indirect heating surfaces and their contours, the heat transfer qualities of the metal comprising these surfaces, the volume and pressure of the draft, and the location of primary heating surfaces with respect to the fire-box. In regard to the last item, it is generally recognized that prior to complete combustion, the hot gases should be kept from contact with primary or direct heating surfaces, since the cooling action of the latter retards combustion and favors the deposit of soot and the production of a smoky exhaust. In order to promote complete combustion it is thought wise by some designers to introduce and mix thoroughly with the burning gases, an auxiliary supply of preheated air, sufficient in quantity to insure an ample supply of oxygen but not enough to cause large loss through heating of excess air. If this can be done without serious reduction of the natural draft, it will undoubtedly increase the boiler efficiency and help to secure the desired smokeless operation.

THE FACTOR OF FIRST COST.

No matter what may be the technical or thermal advantages of a boiler, if its first cost is above the prospective purchaser's estimate of his own buying power, it will not be a commercial success under present conditions. This fact has its influence on the designer in limiting his choice of materials (to iron in place of copper, for instance), in limiting the character of his design with regard to the labor involved in its manufacture (precluding mechanical intricacy which may have certain thermal advantages), and in limiting the weight and dimensions of his design in order to keep down manufacturing and shipping costs.

The customer's estimate of his own buying power is controlled, or at least influenced to some extent, by the facts regarding operating cost. So this factor is also of interest to the boiler designer. The items entering into it are cost of fuel (small sizes of soft coal having an advantage in this respect to offset their other disadvantages), cost of attendance which is of negligible importance in some cases and in others the dominate item), and the cost of repairs (an item closely related to the questions of design intricacy and standardization).

PROBLEM OF OBTAINING ADEQUATE AND RELIABLE TECHNICAL INFORMATION.

Difficulties mentioned in the foregoing paragraphs suggest another problem facing the designer, that of obtaining adequate and reliable technical information. The information resources of any one manufacturer are of necessity relatively limited, even after years of production and testing in the boiler field. Some of the factors affecting boiler design fall without the scope of the individual industrial research laboratory. There is no doubt whatever that the combined data now in the hands of the nation's boiler manufacturers, would enable the design of a smokeless boiler far superior to any now on the market.

This introduces another question, that of patent rights. Based upon the information gained by various manufacturers in the boiler field there have been granted patent rights covering special design features in these makes of boiler, which features are thereby excluded from use by other makes except on unfavorable terms. The designer has to watch his step in this matter of patent rights, since he is prevented from using even the design which he has invented himself, if someone else has previously invented and patented that design, or feature.

It is certain that, upon the basis of these various proprietary features, there could be designed a composite boiler possessing the combined advantages of these features. It is probable that, if a method of industrial combination could be devised which would eliminate the evils of industrial monopoly, the boiler manufacturers of the nation could unite for the production of a better heating boiler than any now available, thus conferring a benefit upon the nation as a whole, while at the same time each manufacturer would benefit by an increased sale of this improved boiler.

Getting back from the possibilities of the future to the practical conditions of the present, the way a boiler designer meets the various problems above mentioned, is to compromise between thermal perfection and commercial demand. Where there are advantages on one side and disadvantages on the other, he balances them and takes that combination of advantages and disadvantages which he thinks will prove most practicable. Where there is a considerable range of variation in any element affecting his design, he tries to strike a "happy medium" which will be approximated under normal conditions. The result of this method of compromise is shown in the accompanying table covering design characteristics of twenty-seven popular makes of smokeless boiler. The general prefcrence indicated under each item must be considered, not as the best design with which to secure any particular effect, but as the design which has so far been found by a majority of these manufacturers best with regard to all of the design factors above outlined.

It is the opinion of the writer that boiler manufacturers are handicapped by articial limitations imposed by the purchaser in respect to first cost. The matter of operating expense is of far more real importance from the standpoint of economy—ultimate economy—and the writer ventures to make the prediction that the growing confidence of the public in the engineering profession, combined with the rising price of fuel, will eventually produce designs of smokeless boilers which will be more expensive to buy, but will be vastly more economical to operate than the designs now available. And the individual buyer and user of these boilers will not be the only one to profit by this development, because the advance will be a big step in the direction of conservation of the nation's fuel resources.

PRESENT STANDARDS OF BOILER CONSTRUCTION

Smokeless Boilers	Materials		Feed			Draft		Grate Arrangement				Auxiliary air		Fire travel		Flue Connection		
Name or Make	C.-I. sectional	Steel fire tube	Magazine feed	Gravity feed	Stoking feed	Up draft	Down draft	Water grate	Single grate	Double grate	Horizontal grate	Inclined grate	Aux. air front	Aux. air side	2—way fire travel	3—way fire travel	Front flue connection	Rear flue connection	Side flue connection
Brownell		x		x			x	x				x	x			x		x	
Capitol	x				x	x			x		x		x			x		x	
Economy	x				x	x			x		x		x			x		x	
Gurney	x			x			x	x			x		x		x			x	
Hart & Crouse	x			x			x	x				x	x			x		x	
Ideal	x				x	x			x		x			x		x		x	
Imico	x			x			x	x			x		x			x		x	
Imperial	x				x	x			x		x			x		x		x	
Kewanee		x		x			x	x				x	x		x		x		
Molby	x		x				x	x				x		x	x			x	
Monarch	x			x			x	x			x		x			x		x	
Murray		x			x	x			x		x		x			x	x		
National	x			x			x	x			x		x			x		x	
Newport	x		x			x				x		x	x		x			x	
Novelty	x				x	x			x		x			x		x			x
O'Brien		x		x			x	x				x	x			x		x	
Oil City		x		x			x	x				x	x		x		x		
Pacific		x		x			x	x			x		x		x		x		
Peerless	x			x			x	x			x		x			x		x	
Perfection		x		x			x	x				x	x		x		x		
Pierce	x		x				x	x				x	x		x				x
Prox	x				x	x			x		x			x		x		x	
Reck	x		x			x			x			x		x	x			x	
Richmond	x		x				x	x				x	x		x				x
Smith	x			x		x			x		x		x			x		x	
Spencer		x	x			x				x		x	x		x			x	
Thompson	x		x				x			x		x	x		x			x	

Standardization Work Being Undertaken by Heating Contractors' Committee.

Plans for future activities as outlined by the Standardization Committee of the Heating and Piping Contractors' National Association at a recent meeting, include the preparation of standard dimensions of radiator valves and standard methods of figuring heat losses. The standardization of radiator valves, it will be recalled, was begun in 1914, but work was dropped, owing to war conditions. Now the committee plans to complete this work.

In comparing methods of figuring heat losses used in different sections of the country the committee has noted the wide divergence in the factors used. It is the purpose of the committee to gather all the data it can find and consider them at its April meeting. In that way it is hoped to formulate a standard method of figuring heat losses.

The committee is made up of Walter L. Fleisher, chairman; Ralph Franklin, Boston; Harry M. Hart and S. Austin Pope, Chicago; M. B. Crowell, Cleveland and E. W. Mandeville, Brooklyn.

Annual Meeting of British Heating Engineers.

Frank Biggin, of Sheffield, was elected president of the (British) Institution of Heating and Ventilating Engineers at the annual meeting of that association in London, February 8. In his address he referred to the scientific work being con-

ducted by the institution and brought out the fact that the hoped-for government financial support had not yet been realized. Referring to the establishment of central hot water supplies and the heating of districts, or even whole towns, from one or more centers, he felt that the time was not far distant when municipal authorities and other public bodies would feel the necessity of giving this matter serious consideration. Practically nothing, he stated, had yet been attempted in this direction, and the possibilities were great. In every town there were many instances of waste heat or gases which could be harnessed to give warmth and hot water supplies to the public buildings, houses, etc., in the immediate vicinity. In addition to the enormous economy which would thus be effected, there would be a vast improvement in the atmospheric conditions by the absence of the many smoking chimneys.

In reporting on the experimental work being carried on at the University College by the Research Committee, E. Herring referred to the recently-published coefficients of heat transmission through heavy building materials which have been practically completed and sent out to the members in the form of a preliminary list of coefficients. The committee, he said, has every confidence in their accuracy and trusted they would prove of value to the heating industry as the standard for the calculation of heat losses. He called attention to the fact that in most cases the values of K is in excess of those given by other authorities. The coefficients will be later incorporated in greater detail in a publication in which it is hoped to include coefficients for thin materials, such as glass and various roofing compositions.

It is intended to secure as complete a list of British standard coefficients as possible. The staff at the college, said Mr. Herring, is now engaged in a series of tests with radiators, with a view of determining the heat transmission of various types.

The principal paper presented at the meeting was on "Dust Removal Equipment, as Applied to Residences, Offices, Public Buildings, Etc.," by R. G. Grierson. Mr. Grierson referred freely to American practice, quoting the methods followed by the U. S. Treasury Department as described in Cooley's "Vacuum Cleaning Systems" and Thompson's "Mechanical Equipment of Federal Buildings." The author very generously referred to these works in his bibliography on the subject, as well as to "Vacuum Cleaning Engineering," by E. J. Moore (Fuller Publishing Co., Seattle, Wash.) and to "Tests of Vacuum Cleaning Systems," a paper by J. R. McColl, presented in 1913, before the American Society of Mechanical Engineers. Mr. Grierson was awarded the silver medal of the institution for his paper.

It was announced that the Henry Saxon Snell prize in connection with the Royal Sanitary Institute would be fifty guineas this year and the medal of the institute for the best essay on "A System of Central Hot Water Supply and Heating."

The summer meeting of the institution will be held at Sheffield, June 20-22; the autumn meeting in London, October 11; and the next annual meeting in London, February 7, 1922.

Tests of the Reck Universal Boiler.

By PAUL HAROLD BERGGREEN.

The first Reck universal boiler to arrive in this country was installed in Philadelphia, where it was demonstrated to the members of the American Society of Heating and Ventilating Engineers during their annual meeting, in January.

Claims of high efficiency and general adaptability to all kinds of fuels have been laid to this new type of magazine-feed low-pressure heating boiler, and though these claims were backed by authoritative tests made at Copenhagen, Denmark, some skepticism has been expressed as to the validity of the claims under such conditions as are existing in actual installations in this country.

Whatever a heating boiler may do in the hands of experts, with exceptional fuel and ideal conditions, the real value of the boiler can only be measured by the results obtained with unselected, undried fuels as they are purchased in the open market, and under ordinary conditions, without constant attention to fire and dampers by someone thoroughly familiar with the particular make of boiler.

In order to verify Danish tests of the Reck universal boiler, I induced the Engineering Department of Drexel Institute to test the boiler, with fuels of their own choice and without interference on my part during the actual tests.

Three tests were made, with anthracite stove, anthracite buckwheat, and soft coal. The magazine was charged at the start of these tests with what was supposed to constitute a sufficient quantity for a 6 to 8-hour firing period, but in the case of soft coal the fuel was consumed in 4 hours. The fire and dampers were not interfered with during the test periods, except in the case of soft coal, which proved highly coking and therefore required occasional poking. Coking fuel is in reality unfit for any magazine boiler, but the present test is included to show the capability of the Reck boiler. The Reck Heating Company rates this boiler, type E-5, at 1150 sq. ft. steam radiation, and the tests were all made at normal capacity.

It may here be said that Danish ratings are actual measurements of a boiler's capacity, namely the heat units delivered at the very outlet of the steam main. This enables the contracting engineer to use his own figures for his particular job to select the proper size of boiler instead of being at the mercy of the boiler manufacturer's inflated ratings.

The feed-water was fed through a calibrated tank by gravity, and the steam was found to be dry and saturated, because the water dripping from a drain on the steam pipe, through which the steam was allowed to escape into the atmosphere, was collected and found equal to the computed quantity of condensation in the pipe. The fuel recovered from the ash-pit was not credited to the test. Results showed overall efficiencies of 84.4%, 81.5%, and 70.48% for stove coal, buckwheat and soft coal, respectively. It is safe to say that these tests prove conclusively the validity of the Danish tests, made in great number and with all kinds of fuels.

Further tests are now being made at the Research Laboratory of the American Society of Heating and Ventilating Engineers at the Bureau of Mines in Pittsburgh.

A History of the Engineering Council.

The fact that Engineering Council was discontinued as a department of the United Engineering Society, by official action of the latter, effective December 31, 1920, has made it seem appropriate that there should be a permanent, comprehensive record of the notable progress made through the instrumentality of the council, in organizing the engineers of the country for service, not only to the members of the profession, but also to national, state and local governments and the public. Such a record has now been published, being designated "A Brief History," by J. Parke Channing, Philip N. Moore and Alfred D. Flinn.

Engineering Council, it will be recalled, was established in the spring of 1917, as a department of United Engineering Society, in response to requests of its Founder Societies, the Civil, Mining, Mechanical and Electrical Engineers. Other associations later represented were the Society for Testing Materials and the American Railway Engineering Association.

The booklet then goes on to tell of the accomplishments of Engineering Council, characterizing as first and most important, the feasibility of a joint representative organization of technical societies to deal with questions "of general interest to the engineers and to the public." Its activities during the war are enumerated as well as those of the reconstruction period.

Under the new title of American Engineering Council, a bright future is predicted for the organization which, it is stated, should come to embrace all the important engineering and other technical societies of common purpose.

The concluding pages of the booklet contain a list of the officers of Engineering Council from 1917 to date, together with the personnel of all the committees that were active during that time.

MANOMETERS are discussed in Bulletin G of the Bacharach Industrial Instrument Co., Pittsburgh, Pa. This concern makes various types of manometers both vertical and inclined, and combinations of the two for measuring small pressures and pressure differences. The catalogue is pleasingly illustrated and carries reference also to other literature of the company bearing upon its other products. Size 6 x 9 in. Pp. 4.

New Apparatus and Appliances

A New Fan Showing Novel Impeller Design.

The Centrifugal Fan Company, of 15 Seventeenth Ave., Newark, N. J., is on the market with a line of fans whose outstanding feature is an impeller of unusual design, which is shown in the accompanying illustrations. Under the trade mark name of "Four Leaf Clover" the concern is supplying these fans made up as window exhausters, wind propelled ventilators, exhaust fans, encased blowers, ceiling fans, and car exhausters, and these run in size from 4 in. up.

FIG. 1—WINDOW EXHAUSTER WITH AUTOMATIC CLOSING DEVICE.

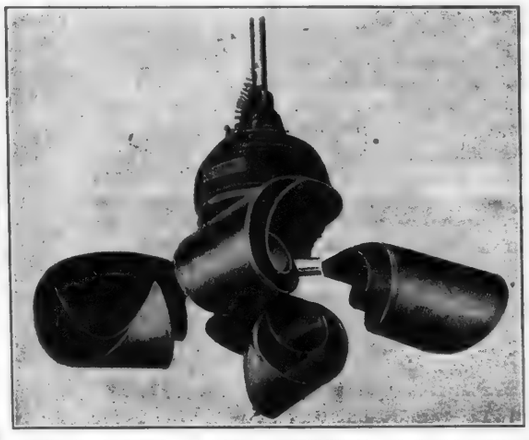


FIG. 2—CEILING FAN SHOWING CHARACTERISTICS OF NEW IMPELLER.

Anything new in the fan line possesses added interest due to the fact that fan design has seemed to be so thoroughly standardized during the past few years, with little deviation among the larger manufacturers from certain recognized types. In the absence of definite test data, it is too early to say anything about either the actual or the comparative efficiency of this type of impeller, but there is no doubt whatever that it can throw air. The mystery of the inner blade is partially cleared up by the manufacturer's explanation that this serves to separate the air stream into two parts and so relieves, or rather prevents, excessive pressure on the outer blade.

In Fig. 2, showing the ceiling ventilator, are best displayed the features of this new impeller design. While in this view the blades are shown attached to intersecting rods, the shape and relative position of these blades is the same as if they were attached to a metal disk, as in some of the other apparatus above mentioned. Each blade consists of two eccentric cylinders fastened together at both ends, but fastened to the rod or disk, as the case may be, at one end only. This means that there is allowed a certain flexibility due to the freedom of motion of the other end. Four of these blades are used, set at 90° intervals and fastened so that their axes are at an angle of about 45° with the radii at these points.

This type of impeller is designed to rotate in the direction indicated by a line from the outer to the inner end of the blade cylinder axis and with this impeller the direction of air motion relative to the blade circle is more nearly radial and less tangential, than that secured with the multivane type of impeller. In other words, the air motion is less restrained by the blade surface in this type of impeller, than in the multivane type. Whether or not this will prove of ultimate advantage in practical service is, as stated previously, a question open to test.

Fig. 3 shows an installation of two types of roof ventilator in each of which the exhaust impeller is of this design. The left hand ventilator is designed for wind propulsion and is claimed by the manufacturer to function effectively on a wind velocity of 3 mi. per hour. The ventilator on the right is operated by an electric motor located in the hood above the fan. The window exhauster shown in Fig. 1 is provided with an automatic attachment for opening the exhaust area during operation and closing it when the exhauster is not running. This prevents the entrance of rain, snow, or dust-laden air under all conditions.

Used as a blower this type of impeller requires a casing only about half the width of a multivane blower of the same capacity, according to manufacturer's statement. Since it is in this class of equipment that fans are of most interest and value to the heating and ventilating industry, it is desirable that impartial test data, bearing on the performance characteristics of this impeller, shall be presented to the industry at an early date.

Alclin Slide Rule for Computing Direct Radiation.

A slide rule for rapid computing and checking of computations of direct radiation for all types of building construction and for various temperature differences, is presented in the Alclin slide rule manufactured by the General Heating Supply Company, Kansas City, Mo. This rule is based upon B. T. U. loss factors determined and used by leading authorities in the heating profession. Some thirty or more types of building construction are shown on this rule and others can be added as future tests and experiments determine more accurately the heat losses through other materials.

The Alclin slide rule carries four scales, marked A, B, C, and D—two of which are stationary and the other two movable. Scale A (stationary) shows resulting amounts. Slide B (movable) contains amounts corresponding to known areas or lengths to be computed. Slide C

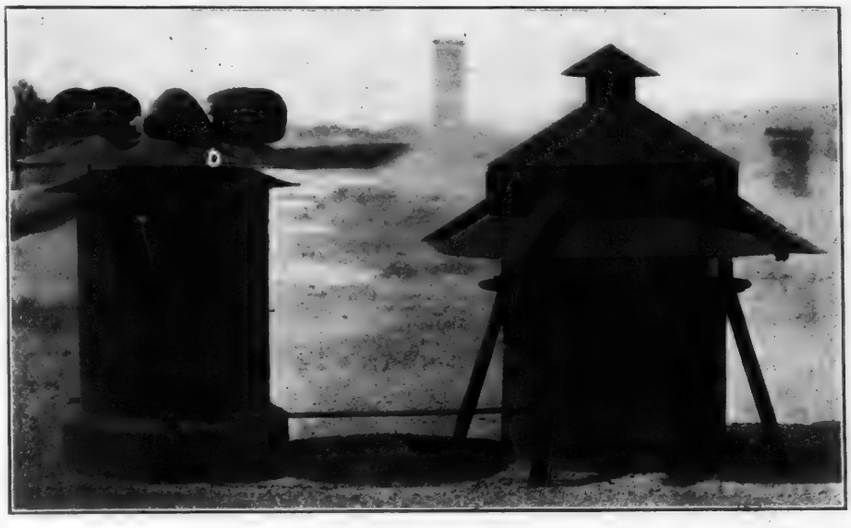
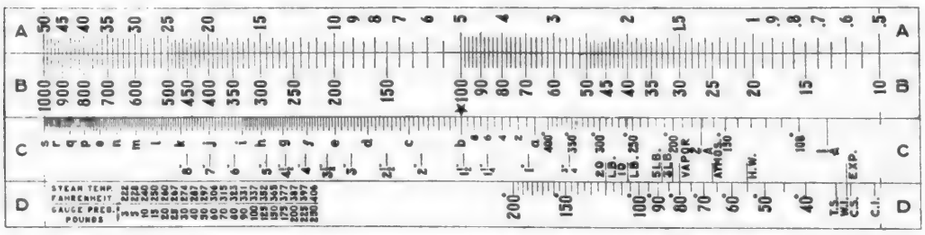


FIG 3—CENTRIFUGAL ROOF VENTILATORS OPERATED BY WIND (LEFT) AND ELECTRIC MOTOR (RIGHT).

(movable) contains heat loss symbols corresponding to the factor used for the various types of construction. Also—the scale of various temperatures and pressures for pipe expansion; graduations for the various heatings systems at different pressures; and graduations for



ALCLIN SLIDE RULE FOR COMPUTING DIRECT RADIATION.

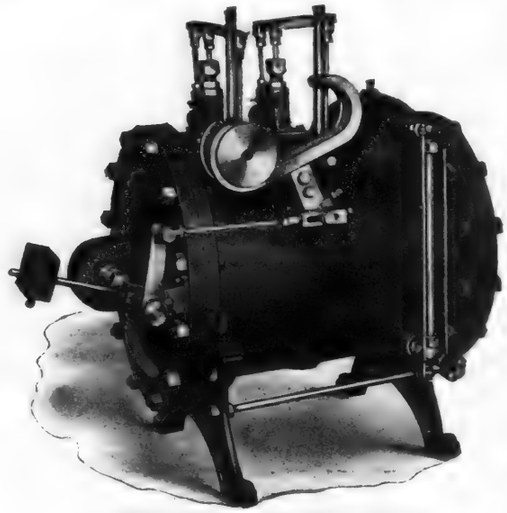
computing heating surfaces of various sizes of pipes. Scale D (stationary) contains graduations for the various temperature differences desired for computing radiation.

This slide rule is made of wood, with graduations on celluloid. It measures 10 in. long by 1⅛ in. wide and is supplied with runner, case, and instructions complete for $10. The same rule is also obtainable in metal, either 5 in. or 10 in. long as preferred, for $7.50.

Sterling Vacuum Trap.

On low pressure return lines where the condensation is sluggish or the circulation poor, is where the Sterling vacuum trap finds special application. This trap, manufactured by the Templeton Manufacturing Company, Hyde Park, Mass., creates in operation a vacuum of as high as 20 in. of water and this keeps the return piping always free of water. This feature is of particular advantage when there is a large amount of radiation tied up in a single return line, because the great pulling power of this vacuum will keep the line clear at all times.

Sterling vacuum traps are fitted with three valves—steam, water injection, and air release. In these traps cold water is automatically sprayed throughout the trap casing when it is full of steam, after the steam valve is closed. The water injection valve communicates with the internal spray pipe through which is fed the cold water for condensing the steam and creating a vacuum. This condensing water can be used for make-up water to the boiler. The air release valve ejects all the air from the system and a vacuum can be created in the trap, without the use of water, by allowing the steam to condense in the trap after the discharge has been made.



NEW STERLING VACUUM TRAP.

Referring to the sectional illustration, when the trap is filling the two valves on the right are open and the steam valve on the left is closed. When the proper height of water has been reached the roller weight rolls over to the other end of its hooked guide and this action closes the two left hand valves and opens the steam valve, admitting steam which forces the water out of the trap. The float follows the water down and as the trap empties the roller weight returns again to its initial position closing the steam valve and opening the water valve. This produces the spray effect and the condensation of steam with resulting creation of a vacuum within the trap. The vacuum draws in more water and the cycle is repeated.

The satisfaction of knowing at all times just how the trap is functioning is provided in the Sterling vacuum trap by equipping it with a gauge glass which gives continuous indication of conditions within the trap. Another feature is the provision of a means for adjusting the capacity of the trap to the variations in service requirements which may be for frequent discharge of small volumes of water or for discharge of larger volumes at less frequent intervals. This adjustment consists of a pair of sliding link rods which connect the rocker arm on the float mechanism with the valve operating device. On the ends of these links are set screws which when tightened or loosened control the height of the water level at which the trap receives and discharges.

Vaco Valve and Check.

The accompanying sectional view of the combined Vaco valve and check is almost self-explanatory as to the construction and operating principle. To the valve, which is substantially the same as other radiator valves for use on steam systems, there is attached the vacuum check valve, consisting of a ball-valve mechanism which permits the upward passage of air expelled from the radiator by incoming steam, but prevents the return or downward passage of air into the radiator when the steam pressure falls. In effect this tends to transform an ordinary steam pressure heating system into a vacuum heating system, and the efficiency of the method depends in part upon the extent to which this ball-valve mechanism will form and maintain a vacuum in the radiator.

ASSEMBLY OF VACO VALVE AND CHECK.

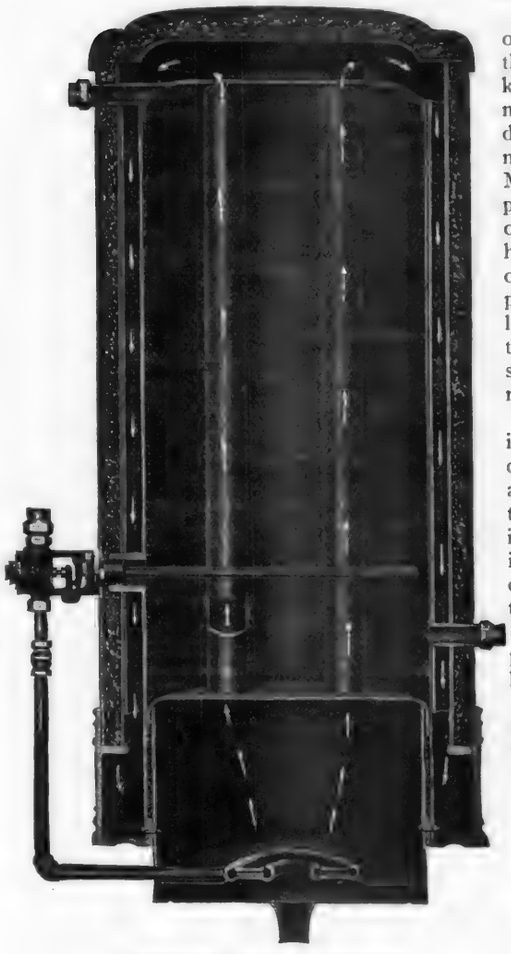
Patents covering this device have been granted to C. Feuser & Son, of Bloomfield, N. J., by whom the device is being marketed. The Vaco valve and check are sold either together or the check separate as desired. The check can be attached to most of the usual forms of steam radiator valves, according to statement of the manufacturers.

Ever-Hot Water Heater.

A new gas-fired water heater, called the Ever-Hot heater and manufactured by Frank W. Shuell of Detroit, Mich., has several features worthy of special attention. From the sectional view shown herewith, it is seen that the heater consists of an insulated casing enclosing a water tank and combustion chamber. The gas burner used is of a special flat design which is claimed to be more efficient than the Bunsen type of burner and to be free from the danger of back-firing to which the latter type is subject. This

burner rests on the bottom of the combustion chamber and directly above it are located four cylindrical flues which pass vertically through the water tank, providing a passage for the upward travel of the heated gases whose downward return is made around the outside of the water-tank shell.

Regulation of the burner is automatic, secured by thermostatic control of the



EVER-HOT WATER HEATER.

flow of gas to it. Since both inlet and outlet of the gas flow are located at the bottom of the heater, there is a tendency, when the flame is shut off, for the hot gases to remain in the heater for some time rather than to be dissipated into the air. A pilot light arrangement, supplementing the thermostat regulation, makes the heater operation continuous as well as automatic and this light generates enough heat to maintain the temperature of the water in the heater at any usual temperature when there is no hot water being used in the system.

Manufacturer's claims for this heater are better, more rapid service, greater simplicity, reliability, durability, and economy, smaller first cost and less operating expense, and absolute safety.

Time Punch New Feature of Temperature Recorder.

It is one thing to settle upon a specific working temperature as being most efficient in a given heat-treat process, but it is quite a different thing to maintain that temperature. No matter how accurate a heat-recording instrument may be, it can do no more than indicate fluctuations of temperature. The "human element," untrustworthy at best, must be relied on to see that these fluctuations do not go beyond definite limits. If they do, the whole end and object of a recording thermometer is defeated.

Arguing along these lines, the makers of the well-known Columbia recording thermometers have just put on the market, as an attachment to their instruments, a time punch device which reduces the uncertainty of the "human element" to the lowest possible minimum. Making his rounds to inspect the temperature record, the operator in charge of temperature-control now registers the hour and minute of his visit by means of the time punch. Every time a temperature reading is taken he presses the little button on the lower right side of the Columbia recording thermometer, and simultaneously a hole is punched in the margin of the revolving chart.

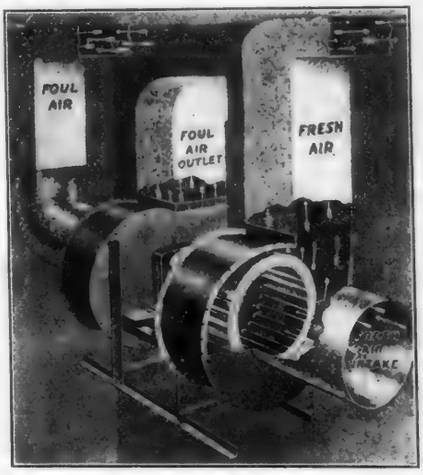
The value of the time punch is apparent in any plant where accurate temperature control forms a part of routine processes, and the greater the necessity for maintaining an even temperature, the greater its worth. By means of the time punch in combination with the Columbia recording thermometer, a saving of many thousands of dollars yearly may be effected in plants that employ heat-treat processes, or that otherwise depend upon heat-regulation for operating efficiency. In fact, the usefulness of the time punch is as broad in range as the usefulness of the Columbia recording thermometer itself.

TIME PUNCH DEVICE ON TEMPERATURE RECORDER.

The manufacturers of the Columbia recording thermometer, the Schaeffer & Budenberg Manufacturing Co., Brooklyn, N. Y., announce that all standard types of disc recording thermometers will in future be equipped with the time punch, while those already in use may be fitted with this new device at a nominal cost. In addition, this new time punch will also be applied to the Columbia recording gauges and tachometers.

Trade Literature.

THE SCIENCE OF VENTILATION is explained in a recent pamphlet by the same name, issued by the Hackney Manufacturing Co., St. Paul, Minn. The booklet shows how the Hackney system of ventilation combines the advantages of both the exhaust and the plenum systems, and has many advantages over both. It con-



HACKNEY VENTILATING EQUIPMENT.

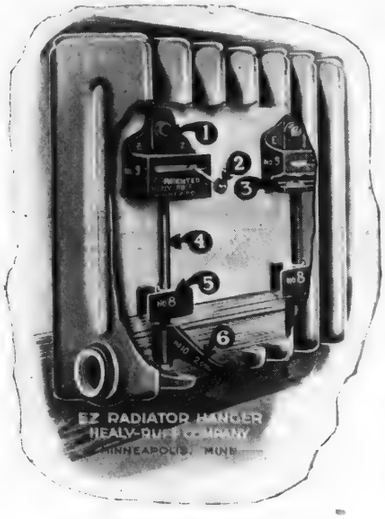
sists of two blowers mounted on the same shaft—one forcing fresh air into the rooms and the other expelling the stale or vitiated air from the rooms. Each blower is connected with a separate system of air ducts so arranged and located that they keep an even distribution and a continuous change of air without drafts or material variations of temperature. A number of testimonials from users of the Hackney system are also given in this pamphlet. Size 4 x 6½ in. Pp. 12.

STURTEVANT AIR CONDITIONING APPARATUS, featuring the manufacturing services of the B. F. Sturtevant Co., Hyde Park, Mass., and the engineering services of W. L. Fleisher & Co., New York, is the title of a comprehensive general catalogue, just issued by these companies. Outside of the illustrations, which are devoted largely to reproductions of views of typical installations of air conditioning apparatus, the catalogue is devoted to a discussion of the principles involved and how they are met with Sturtevant systems. Following an introduction in which is given an explanation of what is involved in air conditioning, the catalogue takes up the spray-type or central-station air conditioning apparatus, as it is termed, with special reference to such items as the nozzles, pumps, means for moving air, means for heating air, means for controlling temperature and humidity, and means for air distribution. The matter of refrigeration is treated in a separate section, supplemented by one on special applications. Under "Services," the point is made that air conditioning is a highly-specialized engineering application, requiring an organization made up of highly-trained engineers. "Such engineering experience," it is

added, "is offered by our companies in their years of experience in building and installing air-handling and conditioning apparatus.' Size 8¼ in. x 11 in. Pp. 48.

THE WEATHER VEIN is the title of a new monthly publication sponsored by the Carrier Engineering Corp., New York, and devoted to the interests of that concern in the air conditioning field. The first issue of this periodical appeared in January, 1921, and its principal theme was the advantage of air conditioning in bakeries which was developed by the motion picture method. The February issue was the Confectioners' Number and by the same method it displayed the advantage of air conditioning in candy manufacture. Textiles had their inning in the March issue, which contained also a list of mills in which Carrier equipment is making "Every day a good day." The pamphlets are well illustrated. Size 4 x 7 in. Pp. 32 in each of the last two issues.

E-Z RADIATOR HANGERS are advocated in a folder just issued by the Healy-Ruff Co., Minneapolis, Minn. This hanger is a patented, adjustable, and invisible



E-Z RADIATOR HANGER.

means of support for radiators which is claimed to be a favorite with the man who hangs the radiators and to have advantages as well, for the architect, the heating contractor, and the owner. Size 3½ x 6 in. Pp. 6.

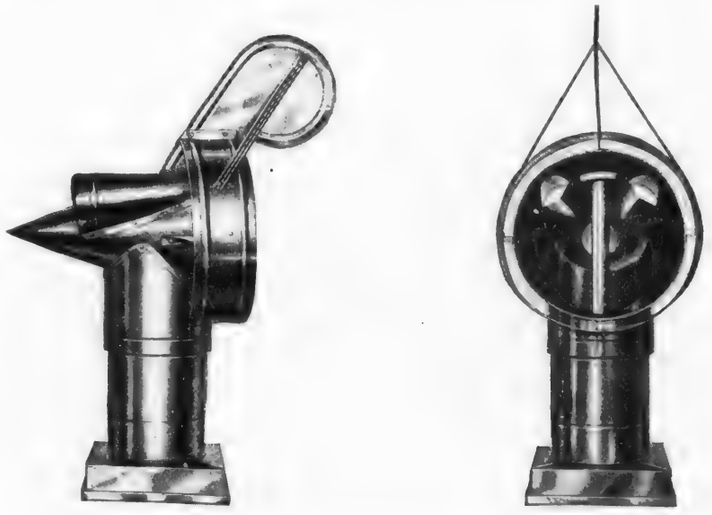
ADSCO ROTOMETER, a liquid-flow meter manufactured by the American District Steam Co., North Tonawanda, N. Y., is described in Bulletin No. 151 recently issued by that concern. This meter is adapted to use for measuring the flow of any thin liquid not under pressure. It is made in sizes suited to caapcities of 350 lbs. per hour upward. Among the liquids for measurement of which it is especially fitted are condensed steam, oil, water, brine and other liquids of low viscosity. The mechanism of this meter is so designed that the indications are positive, continuous operation depending upon the continuous filling of compartments in the rotor. In this meter the counter is arranged to give direct readings in pounds. The meter, as a whole, is remarkably light, considering its measuring capacity. Views of the assembly and parts, as well as table of sizes and capacities, are given in the pamphlet. Size 6 x 9 in. Pp. 8, punched for binding.

ACME AND AIROUT VENTILATORS of the automatic rotating type are illustrated and described in a recent folder of the Acme Ventilator Corporation, Boston, Mass. This folder explains the uses and advantages of both types and gives dimensions, capacities, and prices on the several sizes of each, together with sample letters of recommendation from users of the ventilators. Size of folder 3½ x 6¼ in. Pp. 6.

HEATING RATES, for 1920-1921, are summarized from the records of the National District Heating Association in Bulletin No. 5-B of the Ric-wiL Co., Cleveland, O. The rates given cover both steam and hot water services provided in numerous cities throughout the nation and this digest gives in condensed form information of large value to the central heating industry. An illustrated advertisement of the Ric-wiL sectional vitrified title conduit appears on the back cover of this bulletin. Size 8 x 10¾ in. Pp. 4.

ATMOSPHERE is the name of the latest publication of the American Blower Co., Detroit, Mich., and "atmosphere" is the right word. This pamphlet has it. Supplementing the brief legend which advocates Sirocco equipment, there are given some artistic views of buildings in which that equipment has been installed. The front cover shows the Public Library, Indianapolis, Ind., and the other buildings shown are the City Hall, Oakland, Cal., the Civic Library, Montreal, Que., the Michigan Union Building, Ann Arbor, Mich., the Alexander Hamilton School, St. Louis, Mo., the Guarantee Trust Building, New York, and the Lincoln Motor Company Plant, Detroit, Mich. We call this pamphlet a masterpiece of advertising art. Size 8½ x 11 in. Pp. 4.

STANDARD SPECIFICATIONS for Perforated Radial Brick Chimneys is the caption of an interesting catalogue issued by the M. W. Kellogg Co., New York, describing its standards in the construction of chimneys of that type. In addition to the suggested specifications, covering every phase of chimney design and construction, the catalogue contains dimension tables, sectional views of typical chimneys, and a chart of load curves. The technical material is tastefully enclosed in an art cover. Size 8¾ x 11 in. Pp. 12, including the chart.

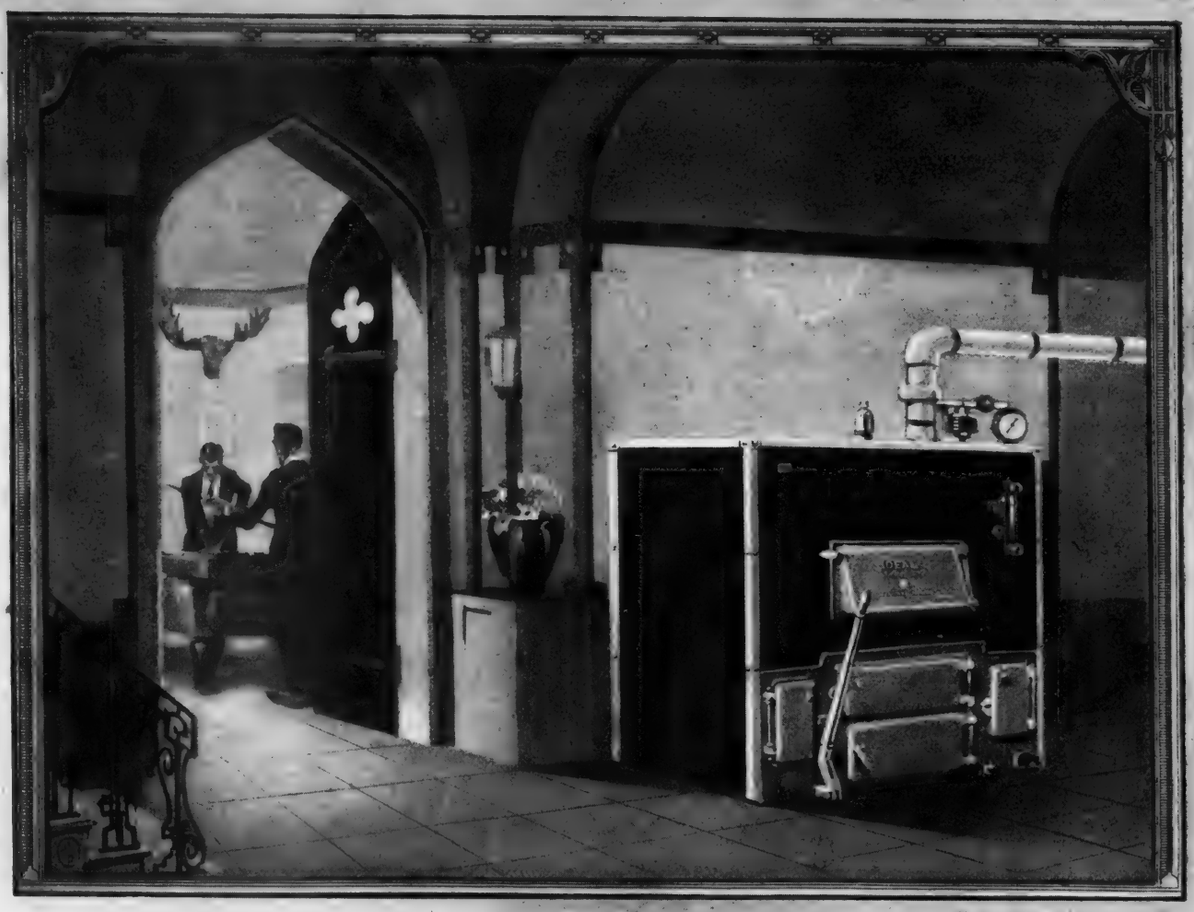


SIDE AND REAR ELEVATIONS OF ACME VENTILATOR.

MILLER STEAM TRAPS are the subject of a folder just issued by the manufacturer, Charles J. Miller, Philadelphia, Pa. There are two types of steam trap described and illustrated in this folder, Model A being a vertical, non-return trap, while Model B is a horizontal trap providing for return to the boiler. In both types the float mechanism serves simply to operate a small pilot valve which in turn controls the steam supply to a steam-operated discharge valve. This arrangement provides greater capacity than can be attained where the discharge valve is operated by the float mechanism direct. The operating cycles for both types of trap, are explained in this folder. Size 3½ x 6¼ in. Pp. 6.

New Publications.

ANALYSIS OF IOWA COALS, by George A. Rice, A. C. Fieldner, and F. D. Osgood is the title of technical paper No. 269 just issued by the Bureau of Mines. This paper gives a history of the coal mining industry in Iowa and tells about the characteristics of the deposits in that state. The price of this paper is five cents and it can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.



THE IDEAL TYPE "A" HEAT MACHINE

OWNERS of this highly refined Heat Machine enjoy an average fuel saving of 33⅓%. This is shown by records of thousands of installations. Long recoaling periods and automatic control assure a luxurious heating service hitherto thought not obtainable in the private home.

The compact construction, handsome finish, dust-free jacket and gas-tight doors make it a feature of the remodeled basement.

Send for catalog showing heat test charts and construction detail.

AMERICAN RADIATOR COMPANY

Sales Branches and Showrooms in all large cities

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HEAT LOSS TABLES.

Index of Authorities Quoted.

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B—Alfred R. Wolff. Translation of requirements of the German Government—*Journal* of the Franklin Institute, Vol. 138, July, 1894, p. 45. Also Transactions American Society Heating and Ventilating Engineers, Vol. 3, 1897, p. 21.

C—Recknagel and Reitschel. Values interpolated by Kinealy. See "Formulas and Tables for Heating," 1899, p. 35. See also THE HEATING AND VENTILATING MAGAZINE, July, 1915, p. 21.

D—J. H. Kinealy. Construction used in this country but not in Germany. "Formulas and Tables for Heating," 1899, p. 35.

E—R. C. Carpenter. Translation from Péclet, "Heating and Ventilation of Buildings," 1911 (fifth edition).

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H—Nelson S. Thompson—"Mechanical Equipment of Federal Buildings," 1915.

H-a—Federal buildings based upon figures of Professor S. Homer Woodbridge.

H-b—Factories or other buildings of inferior construction.

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J—Buffalo Forge Co., "Fan Engineering," 1914. Also Catalogue No. 197, 1908.

K—William G. Snow, "The Principles of Heating," 1912. Calculated from data published by Kinealy in "German Formulas and Tables for Heating and Ventilating Work," (Given for a 70° F. difference and when reduced to 1° F. difference do not check with other authorities.

L—Charles L. Hubbard, "Power—Heating and Ventilation," Vol. 2, 1914. Values given are for most thorough construction.

For ordinary well-built house,	add 20%.
For fairly good construction,	add 20%.
For poor construction,	add 30%.

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R—National District Heating Association. Compiled by Professor C. B. Veal, *Bulletin* N. D. H. A., Jan. 15, 1916.

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U—Frank L. Busey, "Transmission of Heat Through Building Materials," *Power*, April 21, 1914, p. 574.

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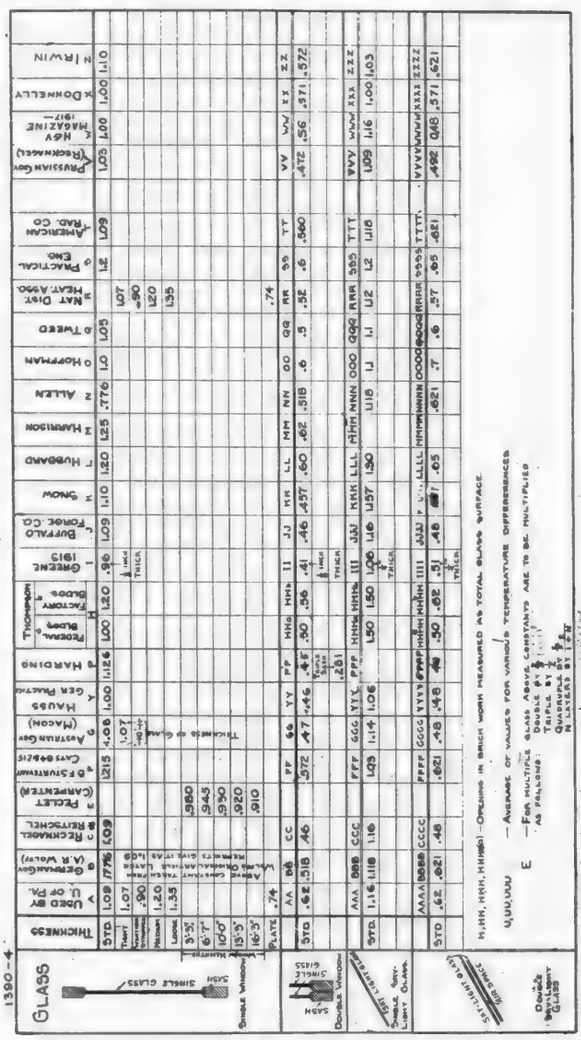
W—The Heating and Ventilating Magazine, "Standard Heating Data Sheets," February and March, 1917.

X—James A. Donnelly, "The Establishment of Standard Methods of Proportioning Direct Radiation and Standard Sizes of Steam and Return Mains." (Trans. A. S. H. V. E., Vol. 21, p. 529).

Y—Charles F. Hauss, Antwerp, Belgium. To figure heating work accurately. Constants obtained from practice of German engineer, Adolph Block, of Hamburg. (Trans. A. S. H. V. E., Vol. 10, 1904, p. 114.)

Z—E. N. Irwin, "Elements of Heating," *Power*, Jan. 20, 1914, p. 89.


GLASS
THICKNESS
STD.
USED BY U. OF PA.
GERMAN GOV (A.R. Wolff)
RECKNAGEL
BRITSCHELL
PECLET (CARPENTER)
U.S. GOV'T STEAMSHIPS
ASTRIAN GOV (MACON)
HAUSS
GER. ELECTRIC
HARDING
FEDERAL BLDG. FACTORY BLDGS.
THOMPSON
GREENE 1913
BUFFALO FORGE CO.
KING
HUBBARD
HAMILTON
ALLEN
HOFFMAN
TWEED
NAT. DIST. HEAT. ASSN.
PRACTICAL ENG.
AMERICAN RAD. CO.
RUSSIAN GOV (Reckenagel)
HEAT MAGAZINE 1917—
DONNELLY
IRWIN
Single Window
Double Window
Single Glass
Double Window Double Glass
Double Window Single & Storm Sash
Double Window Double Glass
Single Window Double Glass
Single Window Single Glass
Double Window Single Glass
Single Window Double Glass
Double

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

GLASS

	Thickness	A Used at U. of Pa.	B Reichnagel & Reitschel	C Austrian Gov (Macon)	D Irwin	E Thompson	F Snow	G Tweed	H Nat. Dist. Heat. Assoc.	I American Rad. Co.	J Greene – 1913	K H&V Magazine 1917					
Single Window Wire Glass		1.09		1.04	1.0			1.35									
Single Window Double Glass		.62	CC .62				KK .614					WW .62					
Single Monitor Glass	STD.	1.30				HHH 1.40 / 1.35			RRR 1.10	TTT .950							
Window Glass Wet		1.10									III 1.1 / 1.1 THICK						

Federal Std.
Mid-Factory
X Openings in brick work measured at total glass surface
Repr. Vol. No. 2 Jan. 15, 1916

WALLS

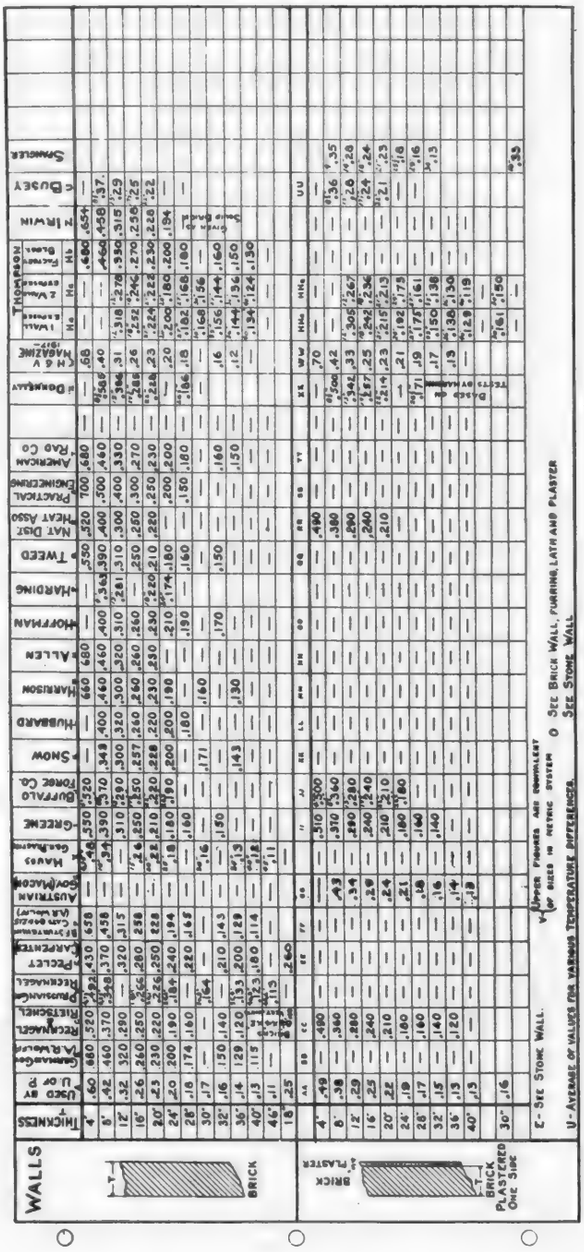
	Thickness T	A Used by U. of P.	B German Gov. (Wolff)	C Reichnagel Reitschel	D Kinealy	F Hubbard	G Austrian Gov (Macon)	J Greene (1913)	L Buffalo Forge Co.	O Hoffman	P Harding	S Tweed	R Nat. Dist. Heat Assn	M Thompson – One Wall Exp.	N Thompson – Two Walls Exp.	K H&V Magazine 1917	X Donnelly	C Busey
Brick Plastered Both Sides	4"	.43		.43												.43		
	8"	.35		.33			.40									.33		
	12"	.28		.26			.31									.26		
	16"	.24					.26											
	20"	.21					.22											
	24"	.18					.19											
	28"	.17					.17											
	32"	.15					.15											
	36"	.13					.14											
	40"	.13					.13											
		AA	BB	CC	DD	LL	GG	H	JJ	GG	PP	GG	RR	HH	HH	WW	XX	UU
Brick Furring, Lath and Plaster One Side	4"	.33		.29	.28			.28	*.28			.28	.29			.36		
	8"	.27		.24	.23	.32		.24	**.23	.280	***.217	.24	.27			.30	****.14	*****.23
	12"	.23		.21	.20	.26		.20	***.20	.217	****.193	.20	.24	.265	.232	.23	*****.300	******.20
	16"	.21		.20	.18	.21		.18	****.18	.182	*****.196	.18	.21			.20		*******.18
	18"	.20												.210	.205		******.226	
	20"	.19			.16	.18		.16	******.16	.161		.16	.18			.18		
	21"	.18												.187	.185		*******.200	********.16
	24"	.16				.16		.14		.147	********.132	.14		.167	.150	.16		
	27"	.15												.152	.140		*********.137	
	28"	.15				.14		.13		.133		.13				.14		
	30"	.14												.140	.130			
	32"	.13						.12		.119		.12				.12		
	38"	.13												.130	.120			
	36"	.12												.120	.113			
	40"	.11												.112	.103			

Brick
Furring Lath Plaster
Brick
Plaster ½ Brick ½ Plaster
Brick Plastered Both Sides
Brick Furring, Lath and Plaster One Side
Glass
Air Space
Sash
Monitor Sash
Wet Surface
Thick

* 7" Hoffman Walls
** Glass at 40% of plain brick
*** The values of Reichnagel Reitschel are based on the assumption that the plaster is on furring strips
**** Based on Hoffman
***** Based on Harding
****** Based on Tweed
******* Based on Thompson
******** Based on Thompson
********* Based on Harding

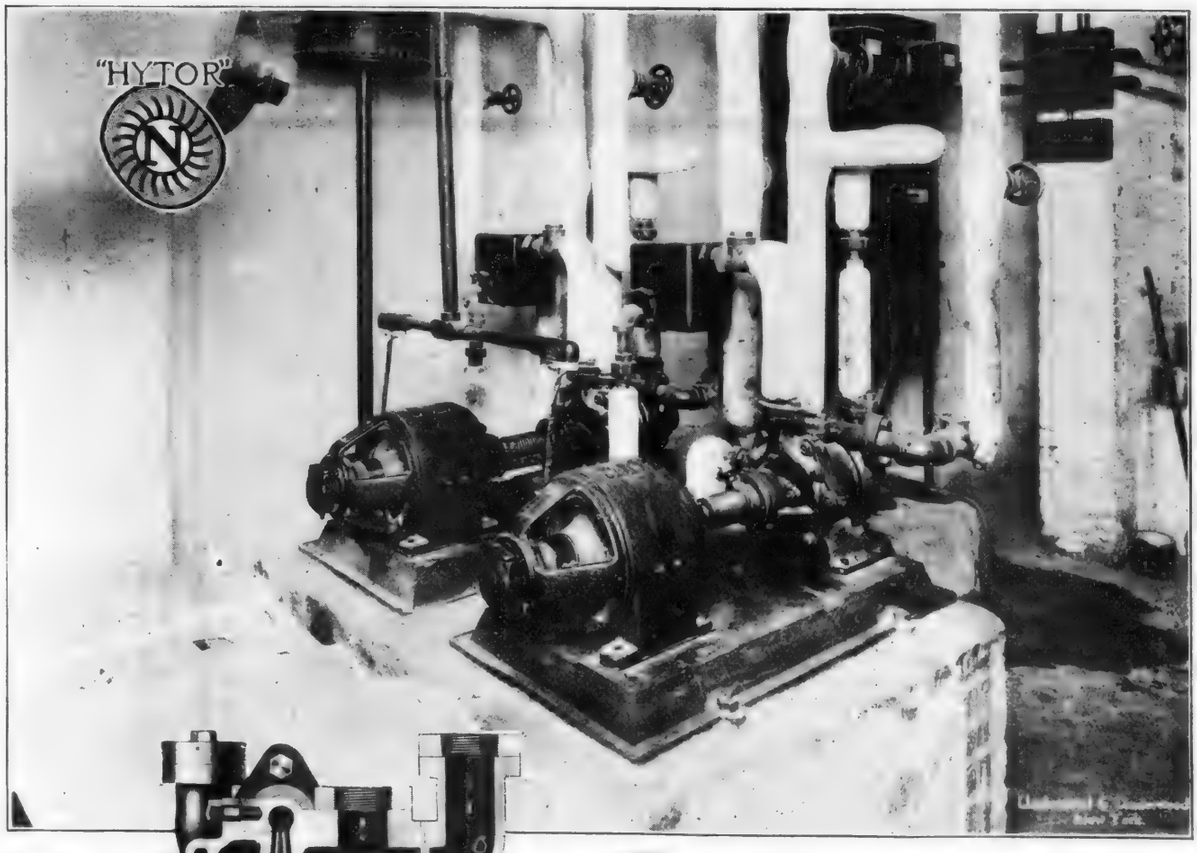
B. T. U. LOSSES—Jones Tables (Continued). No. 1-J.

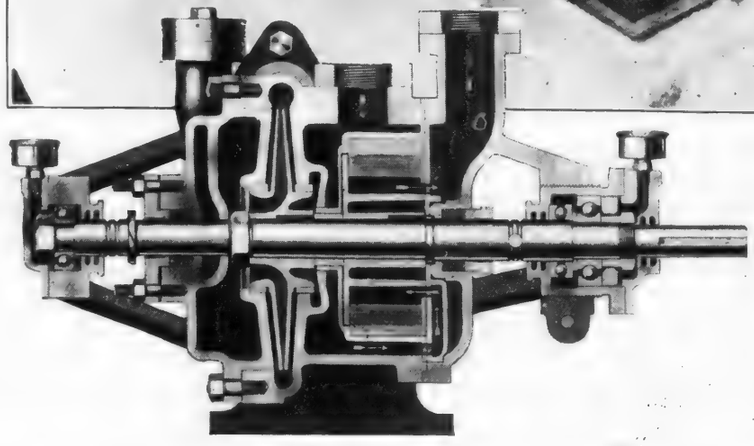
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY



B. T. U. LOSSES—Jones Tables (Continued). No. 1-K.

EFFICIENT HEATING *demands the* JENNINGS PUMP





Duplex B Unit, Continuous Operation

OFFICE BLDG.
21 EAST 40TH ST., INC.
New York City

Capacity each pump 16,000 sq. ft. direct radiation; air capacity 11 cubic feet per minute in addition to a water capacity of 22 gallons per minute.

The motors are only 1½ H. P.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mo unted outside of casing. The one moving element revolves without contact.

There are many other reasons why the Jennings is being installed on practically all of the big jobs' Bulletin No. 8 gives them in detail. Write for it.

NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

April 27-28, 1921.—Ninth annual meeting of the National Federation of construction Industries, in Atlantic City, N. J.

May 30-June 2, 1921.—Thirty-second annual convention of the Heating and Piping Contractors' National Association in Boston, Mass. Headquarters at the Hotel Brunswick, Copley Square.

June 14-16, 1921.—Semi-annual meeting of the American Society of Heating and Ventilating Engineers, in Cleveland, O.

June ——, 1921.—Twelfth annual convention of the National District Heating Association, at Cedar Point, O. Headquarters at "The Breakers."

Miscellaneous Notes.

Chicago Association of Consulting Engineers is the title of a new organization in that city, comprised of mechanical, electrical and sanitary engineers. The object of the organization is to advance the professional interests of its members. The charter members are Charles D. Allan, Charles G. Atkins, I. E. Brooke, H. A. Durr, Ernest V. Lippe, James B. Lund, George A. Muir, Fred J. Postel. Philip T. Potter and John D. Small. The present officers are: President, James D. Lund; vice-president, John D. Small; secretary-treasurer, H. A. Durr, 123 West Madison St., Chicago.

John G. Kelly, formerly New York manager of sales for Pierce, Butler & Pierce Mfg. Corporation, has opened an office at 137 East 43d Street, New York, as metropolitan district selling agent for a number of manufacturers of heating and plumbing goods, including the Hoffman Specialty Co. On his retirement from the Pierce, Butler & Pierce Mfg. Corporation, Mr. Kelly was tendered a dinner by his business associates and was presented with a 32d degree Masonic charm, Dr. J. T. Duryea, president of the company, making the presentation.

Chicago, Ill.—As the result of a notice served on the Congress Hotel by Health Commissioner Robertson, the announcement has been made by the hotel that it will spend $50,000 to overhaul its heating apparatus to eliminate smoke.

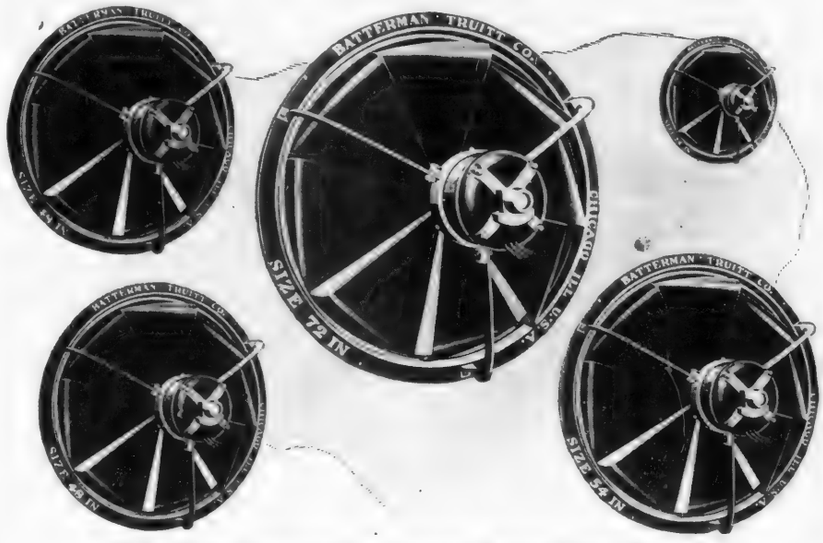
Decatur, Ill.—Ozonizing school rooms was discussed at length at a recent meeting of the Board of Education of Decatur, the subject being introduced by the report of Business Manager Kinkade on the ozonizing apparatus installed in the lockers of the high school gymnasium. The report spoke so well of the results obtained that additional ozonizing installations are being considered.

Elgin, Ill.—Numerous changes are expected to be made in the proposed ordinance regulating the installation of warm-air furnaces and gas-log fireplaces, as the result of conferences between city officials and representatives of furnace companies.

Washington, D. C.—State laws regulating working conditions in metal mines, especially with regard to ventilation, are lax and indefinite, according to a statement made recently by the Bureau of Mines, based on a survey of metal mines in Montana, Colorado, Utah, Nevada, Arizona and other states. The survey was conducted by Daniel Harrington, a mining engineer of the bureau, and by engineers and surgeons of the public health service. "The better health of

"AUTOVENT" Motor Driven Propeller Fans

Trade Mark



Five Units Furnished for Shaiker Heights High School
Cleveland, Ohio

AUTOVENT FAN MOTORS are rigidly protected against moisture, dirt or sediment entering the windings and working parts, which allows the motor windings to be kept clean and free from injurious substances.

AUTOVENT FAN MOTORS are ventilated the only perfect way, which is by elimination of air passing through the motor windings.

AUTOVENT FANS are especially designed and particularly adaptable for handling steam, moisture, acid fumes, restaurant and hotel kitchen fumes, because the motors are of the protective Autovent type.

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BATTERMAN-TRUITT COMPANY

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736-38 W. Monroe St., Chicago, Ill.

Branch Offices in all Principal Cities

coal miners as compared with metal miners probably is due to the better ventilation of coal mines," the statement said.

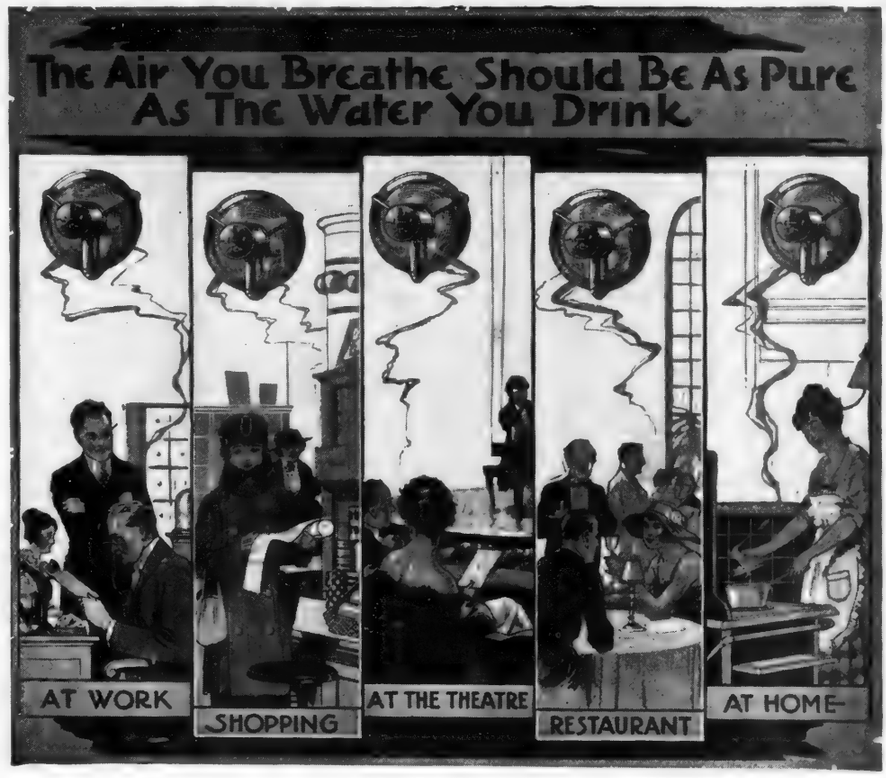
Bloomington, Ill.—Holy Trinity Church is being equipped with ozone machines to improve the ventilation of the church. Four units will be used, located in the galleries of the church.

American Engineering Association, which held its fifth annual convention in Bloomington, Ill., February 18-19, elected the following officers: President, Bert C. Davis, Elmira, N. Y.; vice-president, L. G. Whitmer, Bloomington; secretary-treasurer, W. R. Murphy, Philadelphia. Addresses were made at the convention by F. R. Still, of the American Blower Co., and by Dr. John W. Shepherd, president of the Chicago Commission of Ventilation. The organization is made up of heating and ventilating engineers who specialize in fan blast heating.

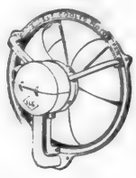
Chamber of Commerce of the United States will hold its ninth annual meeting in Atlantic City, April 27-29, the general theme being, "In the public interest, more business methods in government; less government management of business." Treatment of wages, contract cancellations, better accounting methods and the need of national statistics on production will be among the topics considered.

American Radiator Co., Chicago, Ill., announced a 10% reduction in radiation on March 7, this being the third drop since the high peak. The first cut was 12½% and the second reduction, 5%.

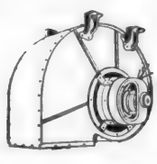
New York.—An ordinance exempting from taxation for a period of ten years dwellings erected between April, 1920 and April, 1922, has been adopted by the New York Board of Aldermen and has been approved by the Board of Estimate so that it has now become effective. This exemption applies only to $5,000 of the value of private dwellings and to $5,000 of the value of each apartment in apartment buildings. This provision was inserted with the special purpose of promoting the construction of moderate-sized homes. It is figured that the average subsidy which will be granted to builders of homes by the tax-exemption ordinance is 28% of the cost of con-



At a very small initial cost and a few cents a day for operation, you can enjoy ideal air conditions by installing one or more ILG Self-cooled Motor Propeller Fans. Let us fully explain how ILG Ventilating Equipment can permanently banish the dangers of stagnant atmosphere, excessive heat, smoke, moisture, fumes, gases, etc.



The ILG Self-Cooled Motor Propeller Fan is the only one made with a fully enclosed self-cooled motor—scientifically cooled by a patented vent pipe which connects with the heart of motor. The guarantee covers the complete unit.



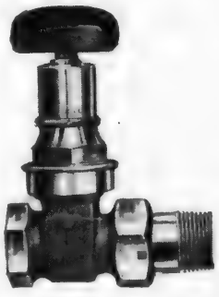
ILG Universal Blowers are built with universal discharge. Motor and blower built together—requires no foundation or pedestal—easy to install—economical to operate—one of the most efficient blowers made. We build and guarantee complete unit.

ILG ELECTRIC VENTILATING CO

2858 North Crawford Ave. Chicago, Ill.

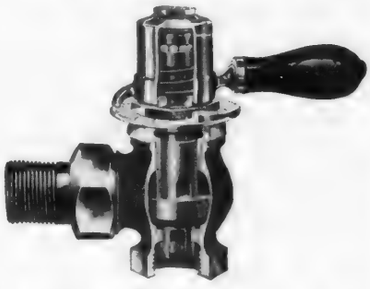
Branches in all large cities

Dole



WE elected years ago to be the builders of the best radiator valves on the market. We have succeeded in our ambition. If any man desires to study the radiator valve field—he will become convinced of the fact that Dole Radiator Valves dominate their market.

A VALVE FOR EVERY SYSTEM



Write for catalogue and discounts

DOLE VALVE CO., Chicago, Ill.
1933 Corroll St.

Jenkins '96 Packing

original unvulcanized sheet packing

Jenkins 96, a black packing, is compounded to form a sheet of great strength and durability, and is recommended for service where saturated steam is used, under all pressures, high and low—equally good for hot or cold water and other liquids.

Ask your supply man

JENKINS BROS.

New York Chicago San Francisco
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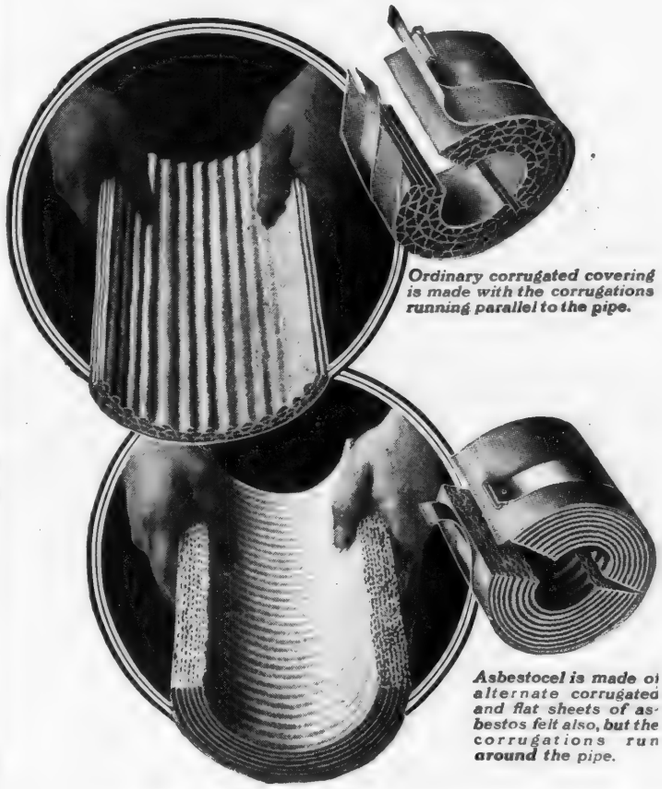
JENARCO Jenkins Packing

Why Asbestocel saves more heat



Ordinary corrugated covering is made with the corrugations running parallel to the pipe.

Asbestocel is made of alternate corrugated and flat sheets of asbestos felt also, but the corrugations run around the pipe.

THE unique "around the pipe" construction of Johns-Manville Asbestocel enables it to save more heat year after year than when the corrugations run lengthwise, or parallel to the pipe, as in ordinary coverings.

The alternate layers of plain and corrugated asbestos felt thus confine the dead air to absolutely closed loops. There can be no lengthwise circulation of air along the pipe.

Moreover, Asbestocel being composed of many small, practically rigid arches, has greater strength and durability as well as greater insulating efficiency.

Ask the nearest branch for the booklet on Asbestocel.

JOHNS-MANVILLE, Inc.
Madison Avenue, at 41st Street, New York City
Branches in 66 Large Cities
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INSULATION
CEMENTS
ROOFINGS
PACKINGS
LININGS
FIRE PREVENTION PRODUCTS

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struction. Already a boom in home building under the impetus of the ordinance is reported by Henry H. Curran, president of the Borough of Manhattan, who has stated that there has been an increase of 61% in building plans filed this year up to April 1, as compared with the same period in 1920.

Detroit, Mich.—The time is at hand when retailers must follow the example of public utility concerns and manufacturers by taking the public into their confidence in regard to their problems, according to Alvin E. Dodd, manager of the Domestic Distribution Department of the Chamber of Commerce of the United States, speaking before the Michigan Retail Dry Goods Association. "The recent period of high prices," he declared, "has brought an insistent demand that the public be shown why the cost of an article generally speaking, should be doubled or trebled between producer and consumer. The public thinks profits have been too large and suspects that too many people are getting them."

American Public Health Association will hold its fiftieth annual meeting in New York City, November 14-18, 1921.

H. Foster Bain, of California, has been appointed director of the United States Bureau of Mines, succeeding Dr. F. G. Cottrell, who resigned to become chairman of the Division of Chemistry and Chemical Technology of the National Research Council. Mr. Bain is well know as a geologist and mining engineer. He was one of Herbert Hoover's assistants in London on Belgian relief work during the war, having been previously editor of the *Mining and Scientific Press*, of San Francisco. For a time during the war Mr. Bain was assistant director of the United States Bureau of Mines, following up production and manufacture of metal products, explosives and other chemical substances for war purposes.

Building Operations for February, 1921, show that building activity has proceeded at a greater rate during the first two months of this year than during the first two months of 1919, according to statistics compiled by the F. W. Dodge Co. Total contracts awarded from January 1 to March 1, 1921, in the 25 northeastern States of the country amounted to $212,437,000, compared with $152,784,000 for the first two months of 1919. The total contracts awarded in February, 1921, was slightly less than in the preceding month. January contracts amounted to $111,648,000 and February contracts to $100,789,000. Among the contracts awarded in February, residential building took the lead, representing 36% of the total. Public works and utilities amounted to 18% of the total, business buildings to 17% and industrial buildings to 9% of the total. New England reported a slight decrease from the January figures. New York State and northern New Jersey was practically the same as in January. The middle Atlantic States showed an increase of 17% over January. In the Pittsburgh district the figures were $7,000,000 less than January. Both the Central West and the Northwest reported figures slightly under the January figures.

Buffalo, N. Y.—Buffalo Steam Fitter Union, No. 665, it is announced by the *Buffalo Commercial*, has renounced the closed shop and in a sweping denunciation of production restrictions and other abuses has come out emphatically for the open shop.

Dwight P. Robinson & Co., Inc., New York, engineers and constructors, has recently opened branch offices in Montreal in the Dominion Express Building. Alexander C. Baker, vice-president, is in charge.

"Own-Your-Home" Exposition in New York, April 16-30, will be a two-weeks' affair this year instead of a six-day exhibition. D. Rait Richardson, president of the Richardson & Boynton Co., has been appointed chairman of the Heating and Sanitation Committee of the exposition, which will be held in the Twenty-Second Regiment Armory, Broadway and 168th Street.

Building Trades Employers' Association, New York, which has been under fire in connection with the Lockwood Committee investigation, has elected new officers as follows, the only hold-over being the secretary, Samuel B. Donnelly: President, Hugh Getty, Hugh Getty Inc.; first vice-president, A. J. Rosenthal, Barber Painting Co.; second vice-president, John J. Grace, Herrman & Grace Co.; treasurer, J. Odell Whitenack.

American Railway Express Company

HACKNEY "V" Blade Blower
Full Housed Overhung Pulley Type

Architects and Engineers:

Send for dimension and data book on Hackney "V" blade blowers.

Sales agents wanted in all territories.

Specify HACKNEY "V" Blade Blowers

Why? Because the "V" blade feature—

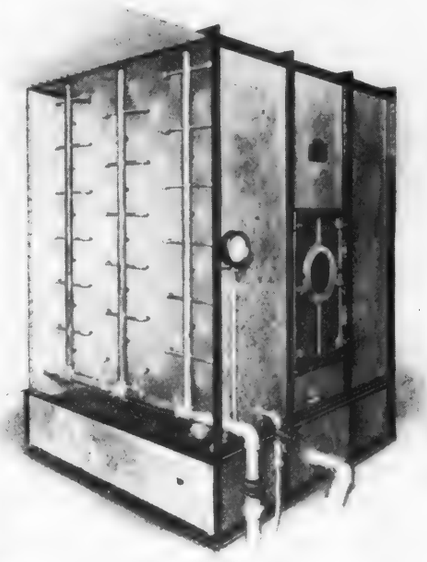
1. Increases Velocity.
2. Increases Capacity.
3. Increases Strength and Rigidity.
4. Increases Momentum.
5. Increases Satisfaction.
6. Reduces Horse Power.
7. Reduces Vibration.

Exhaust system with Hackney "V" Blade Blower installed in a Ford Motor Co. assembling plant. Carries away gases from 25 cars being tested at one time.

HACKNEY MANUFACTURING CO., St. Paul, Minn. Manufacturers of Blowers and Ventilating Equipment for over 12 years

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

SPRACO
AIR WASHERS



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Attested by leading engineers the world over.

INSTALL AN AIR WASHER THAT YOUR CLIENT CAN FORGET ABOUT

The SPRACO CENTER JET NOZZLE

completely **atomizes** the spray, and insures complete scrubbing and cooling of every atom of air.

The eliminator plates are placed vertically so that the Spraco Air Washer is practically

NON-CLOGGING

Continuous operation 24 hours a day and 365 days a year is assured by the

SPRACO AIR WASHER

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SPRAY ENGINEERING COMPANY
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SPRACO PRODUCTS

SPRAY ENGINEERING CO.,
BOSTON, MASS., U. S. A.

has inaugurated a compaign to prevent express shipments from going "on hand," due to incomplete or inaccurate addressing, or for other reasons. Consignees are urged to accept delivery of shipments tendered and not leave them on the carrier's hands, even if the shipments are in bad order. When a shipper is informed by the express company that the consignee to whom he sent his goods has refused to accept them, it will facilitate matters if he will give prompt and definite instructions for the disposal of the shipment in question.

New York's "Own-Your-Home" Exposition which will be held in the 22nd Regiment Armory April 16-30, will have an exhibition, among other things, the three prizes-winning designs for four-room houses that were exhibited at the Chicago show which has just closed, as well as fifty other 4, 5 and 6-room small house designs that were considered the next best.

Edwin A. Scott Publishing Co., New York, publisher of Sheet Metal Worker and Plumber and Steam Fitter, announces the election of Frank K. Chew as vice-president of the company; Henry A. Call as treasurer; and John A. King as director. It is further announced that John E. R. Mudgett has resigned as treasurer of the company.

Manufacturers' Notes.

C. A. Dunham Co., Chicago, Ill., manufacturer of the Dunham system of heating, has removed its offices to the Pelouze Building, at 230 East Ohio Street, Chicago, where it occupies 4800 sq. ft. of space.

Standard Heater Co., Williamsport, Pa., suffered a loss from fire March 3 when its plant, recently purchased from the Spencer Heater Company, was partially destroyed by fire. The loss is estimated at $150,000.

Fulton Co., Knoxville, Tenn., manufacturer of the Sylphon valves and other heating devices, has recently opened branch offices in New York, Chicago, Detroit, Charlotte, N. C., and Knoxville, Tenn. The New York office is at 1476 Broadway; manager, H. K. McCloughlan, formerly with the American Radiator Company. This office is also the headquarters of the company's eastern district sales manager, A. W. King, formerly with the Nelson Valve Company. The Chicago office is located at 7 East Van Buren Street, in charge of C. N. Stedman, formerly of the American Radiator Company, and O. C. Anderson, formerly with the Powers Regulator Company. In charge of the Detroit office is J. R. Loehr, formerly with the American Radiator Company: this office is located at 1247 Washington Boulevard. The manager of the Charlotte (N. C.) office is W. P. T. Mills, formerly with the Fairbanks Company, while the Knoxville office is in charge of G. M. Ellis.

American Radiator Co., Chicago, Ill., reports net profits for the year ending December 31, 1920, of $4,186,889, as compared with $3,571,843 in 1919. The profits amount to 7% on the $3,000,000 outstanding preferred stock and 28.8% on the $13,806,225 outstanding common stock. Based on the present replacement value, the company's inventories show a value of $7,436,234, as compared with $9,573,961 the previous year.

International Heater Co., Utica, N. Y., held its annual convention February 14-17, at which prospects of increased business were reported that promise to tax the capacity of the plant. President F. E. Wheeler welcomed the salesmen and, after luncheon, the party visited the new No. 2 plant, formerly occupied by the Utica Pipe Foundry Company. In the evening an illustrated lecture was given by P. J. Dougherty on "Boiler Construction and Design." Other important addresses made at the convention included one on "Western Conditions and the Business Outlook for 1921," by D. E. McCabe, western sales manager; followed by one on "Eastern Conditions," by C. M. Lyman, eastern sales manager; one on the International's policy, by Treasurer I. L. Jones; advertising talks by Arthur S. Cottins, of the Moser & Cottins Advertising Agency, and by the company's advertising manager, James L. Carr, supplemented by an explanation of the modern follow-up system, by Marian Z. Jones, of the advertising department.

The following day the talks were on such subjects as "Keeping Track of Prospects," "Covering the Territory" and "Small Town Trade." "Suburban Town Trade" was handled by H. Talmadge. "Customers' Complaints," by F. R. But-

LEHIGH
UNIT HEATER
"PUTS HEAT WHERE YOU WANT IT"

CONSTRUCTION

The Lehigh Unit Heater is a strong, sheet-steel housing, enclosing a fan and Vento Heater.

OPERATION

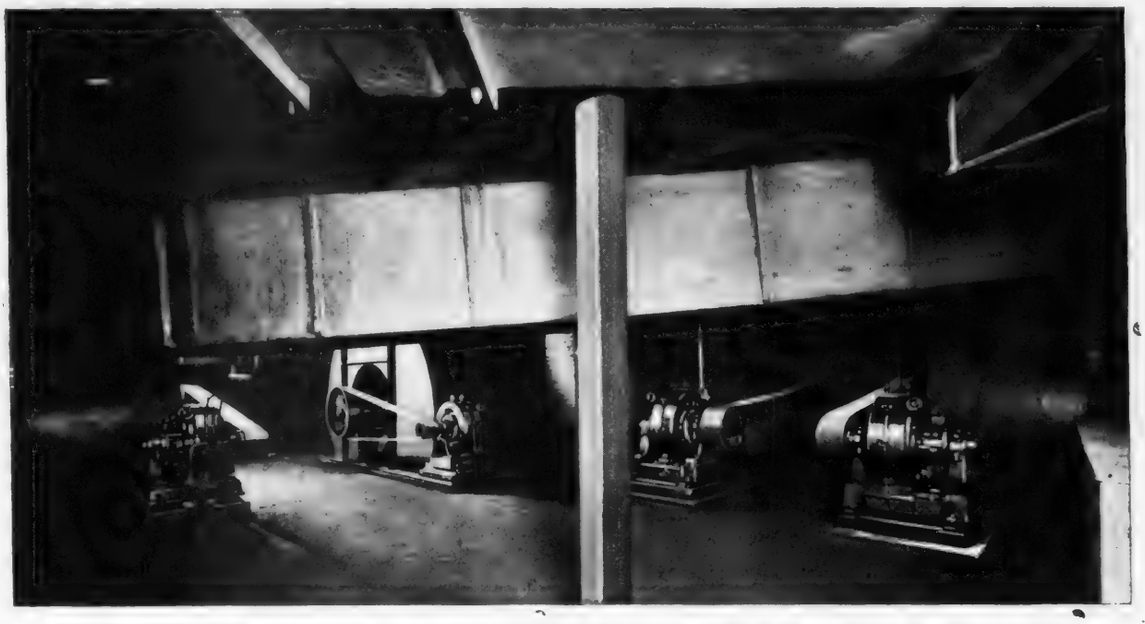
By means of the fan, usually motor driven, the cold air is taken from the floor, drawn over the Vento Heater and discharged under low pressure through the outlet of the heater.

ADVANTAGES

1. Puts heat where you want it.
2. Distributes heat near the floor—not at the ceiling.
3. Provides the most flexible system of heating known. Being portable, is easily moved to any desired part of the building.
4. Eliminates duct work.
5. Cuts power consumption.
6. Spells the greatest economy and efficiency.

Write for special Unit Heater Folder

HERSH BROTHERS COMPANY, 655 Mill St., Allentown, Pa.



This department store veteran installation furnishes the R. H. Macy & Co. store with an unfailing supply of purified air.

EIGHTEEN YEARS OF SERVICE

"Sirocco"
TRADE MARK

IN 1902, R. H. Macy & Co., of New York felt the need of adequate ventilating equipment, and installed a complete "Sirocco" Ventilating System.

Today, after 18 years of steady use, this "ABC" Installation is giving the same kind of satisfactory service as it did at first. This continuous performance is duplicated in many other places where "Sirocco" Products are in use.

It is no light task that the ventilating equipment is called upon to perform in such a mammoth department store. It must not fail to accomplish its work because the functions of the entire business depend to a surprising extent upon the circulation of fresh, clean air throughout the store.

R. H. Macy & Co. Department Store, New York City

AMERICAN BLOWER COMPANY
DETROIT, MICHIGAN

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

ters, "Foundry Problems," by W. G. Jones, "Handling the Order," by C. E. Car and "The Credit Question," by R. L. Griffiths. The convention closed with a dinner at the Hotel Utica where service pins were presented, there being 51 employees who wear service pins, their total years of service amounting to 824 or an average of 16 years each. President Wheeler acted as toastmaster and the speakers included Vice-President Russell Wheeler, D. E. McCabe, C. M. Lyman, F. E. Buckingham, A. DeRosa, I. L. Jones, concluding with a talk on "The Last Look," by President Wheeler.

Iron Products Corporation, 90 West Street, New York, it is announced, has purchased the capital stock of the Molby Boiler Co., Inc., New York, and has elected the following officers: President, G. A. Harder; vice-president, R. R. Rust; secretary and treasurer, Stephen Barker. Mr. Harder is the president of the Iron Products Corporation. It is the intention of the new company to equip a plant which it recently purchased at Mount Union, Pa., for the exclusive manufacture of Molby boilers. It is the company's purpose to specialize in the magazine-feed down-draft type of boiler, not only increasing the output, but developing the market for the boiler in all fields of low-pressure heating. E. C. Molby, the founder of the Molby Boiler Co., Inc., will continue as general manager of sales for the new company.

Success Heater & Mfg. Co., Des Moines, Ia., is the new name of the Wrot Iron Heater Company and Donald B. Howard Heater Company, of Des Moines. The company will continue the manufacture of steel-riveted heaters and will conduct a general business of house and room heaters and the manufacture of such other products as will be consistent with the manufacture of its line of furnaces.

B. & B. Tool & Machine Works, Chicago, Ill., has acquired the exclusive manufacturing and sales rights for the Keystone die stock, formerly manufactured by J. J. Delehant, Chicago. The company has taken larger quarters at Clark Street and Lawrence Avenue.

Fisher Governor Co. and Fisher Supply Co., Marshalltown, Ia., have effected a reorganization and will carry on their business hereafter as separate concerns, instead of departments of the same organization. The officers of the Fisher Governor Co. are: President, M. A. Fisher; secretary, J. H. Fisher. The officers of the Fisher Supply Co. are: President, L. C. Abbott; J. A. McDonnell, secretary.

Sloan Valve Co., Chicago, Ill., has moved into its new factory and office building at 4300 West Lake St., Chicago, which is described as one of the most modern brass factories in the country.

Bristol Industries, Inc., Bridgeport, Conn., has appointed W. W. Cheshire district sales manager for New York, with headquarters in the Woolworth Building. Mr. Cheshire was formerly with the Fulton Company.

Utica Heater Co., Utica, N. Y., at its recent sales convention, had as one of the principal guests, Professor A. C. Willard, of the University of Illinois, who spoke on "Boiler Development, Testing and Ratings." Other topics that proved of special interest were on "Selling the High-Grade Contractor," by A. F. Hem, Chicago manager, and on "Making the Super Work," by R. Doherty, Chicago. "Burning Hard Coke in the Super," was discussed by S. A. Bockius, of Pittsburgh and "Approaching the Architect" by John Bacon, Cleveland. "Selling," by Vice-President James Doherty, Chicago, and "Co-Operation in Selling," by P. M. Beecher, manager of the boiler department. The delegates were welcomed to the convention by President Edward Norris.

Cleveland Gas Burner & Appliance Co., Cleveland, O., manufacturer of the Barber gas burner and the Clevoil burners, reports its new factory under full operation. This plant, it is claimed, is the largest factory in the world devoted exclusively to the manufacture of gas and oil burners. President, Harry E. Kerr; vice-president, Lewis Rumage; secretary, Earl Hungerford.

Whitlock Coil Pipe Co., Hartford, Co., has taken over the manufacturing facilities for producing the Davis line of water heaters and pumps, formerly manufactured by Pratt & Cady, Inc., Hartford.

Bacharach Industrial Instrument Co., Pittsburgh, Pa., has moved into its new

BUCKEYE
BLOWER COMPANY

Announce the opening of a new Sales and Engineering Office

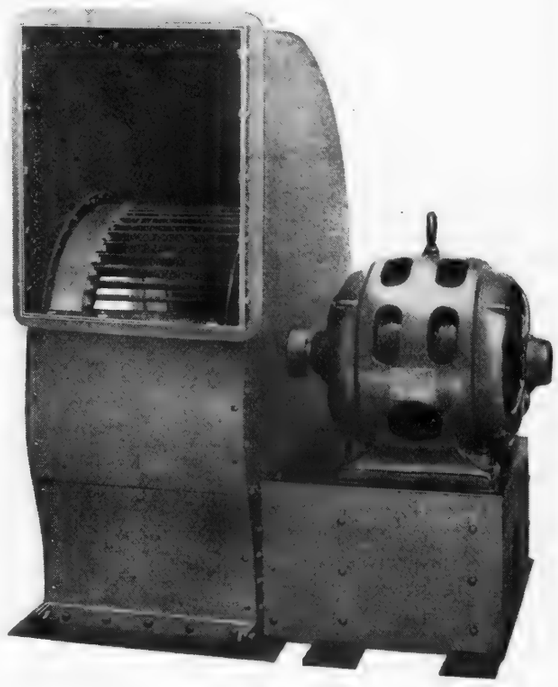
258 Candler Annex
ATLANTA GEORGIA
J. W. Hinchey-Res. Mgr.

This new office is opened for our many friends in the Southern States, so that they will have the full benefit of Buckeye Service.

Write Our Nearest Office.

BUCKEYE BLOWER Co.
COLUMBUS, OHIO

ATLANTA--CHICAGO--CLEVELAND
PITTSBURG--TOLEDO



Increased Production

Up-to-the-minute concerns know that comfort of their employees is the first essential to good production.

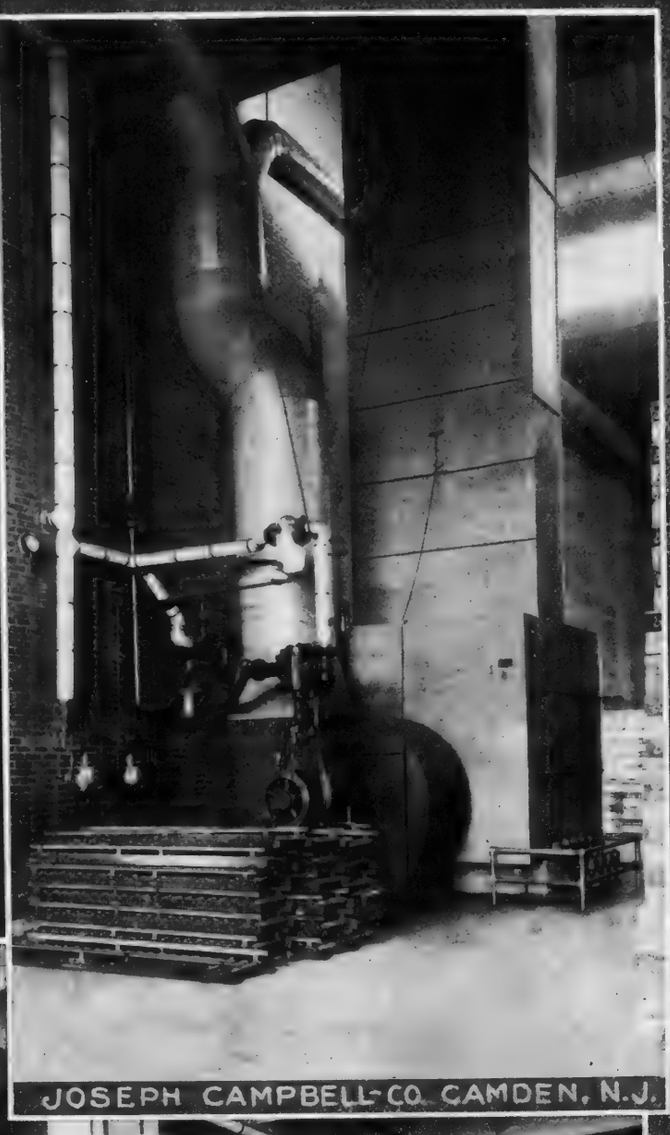
Buffalo Heating & Ventilating apparatus is installed in hundreds of manufacturing concerns.

Catalog 700-36 gives complete engineering data.

Write for your copy.

Buffalo Forge Co.
BUFFALO, N. Y.

"Buffalo"



JOSEPH CAMPBELL-CO. CAMDEN, N.J.

BEECH NUT PACKING CO. CANAJOHARIE, N.Y.

quarters at Homewood Station, Pittsburgh, where the company now has a floor space of 18,000 sq. ft. The additional space acquired by the purchase of the company's new building has considerably increased its facilitiesfor the manufacture of its products, which include gas meters, air meters, pressure recorders, draft recorders, Pitot tubes and orifices, CO_2 indicators, manometers and engine indicators.

Central Station Heating Notes.

Springfield, Ill.—As the result of a special election held in Springfield February 22, the city will assume the ownership and conduct the operation of its entire heating and electrical utilities. The city first engaged in the business of manufacturing heat and light for its citizens in 1915, entering the field with 286 customers. At the end of the third year the city's plant had been enlarged to take care of 1308 customers. The operation of the city's plants then began to have a serious effect on the receipts of the privately-owned corporation, the Springfield Gas & Electric Co. Several months ago the company served notice on the city that unless it withdrew from the utility field the company would have to suspend business when its franchise expired March 15. The vote taken February 22 was on the question of granting a temporary franchise to the privately-owned company until August 15, 1921, at which time the city will absorb the plant.

Following the action of the voters the largest budget in the history of the city was prepared and adopted by the city council. It amounts to $2,881,065 or $952,805 more than last year, the increase representing the purchase price of the Springfield Gas & Electric Company. In order to aid the city in taking over the plant, a company has been organized by local parties known as the Citizen's Electric Co., which will undertake the sale of more than $500,000 worth of stock.

Julius L. Hecht, president of the National District Heating Association, has been elected assistant to the vice-president of the Public Service Company of Northern Illinois. Mr. Hecht has been connected with the company since 1905. He became mechanical engineer in charge of the operation of the stations in 1907 and later superintendent of electrical production.

New Incorporations.

Great New Heating & Appliance Co., Los Angeles, Cal., capital $250,000, to manufacture heating equipment and appliances. Incorporators: Fred F. Harris, W. P. Moon and James H. Clegg, of Los Angeles. G. M. Spicer is at the head of the company.

General Boilers Co., Waukegan, Ill., has been incorporated with a capital stock of $1,500,000 to manufacture steam boilers and boiler equipment. Incorporators: H. M. Reynolds, C. T. Nelson and A. H. Christman.

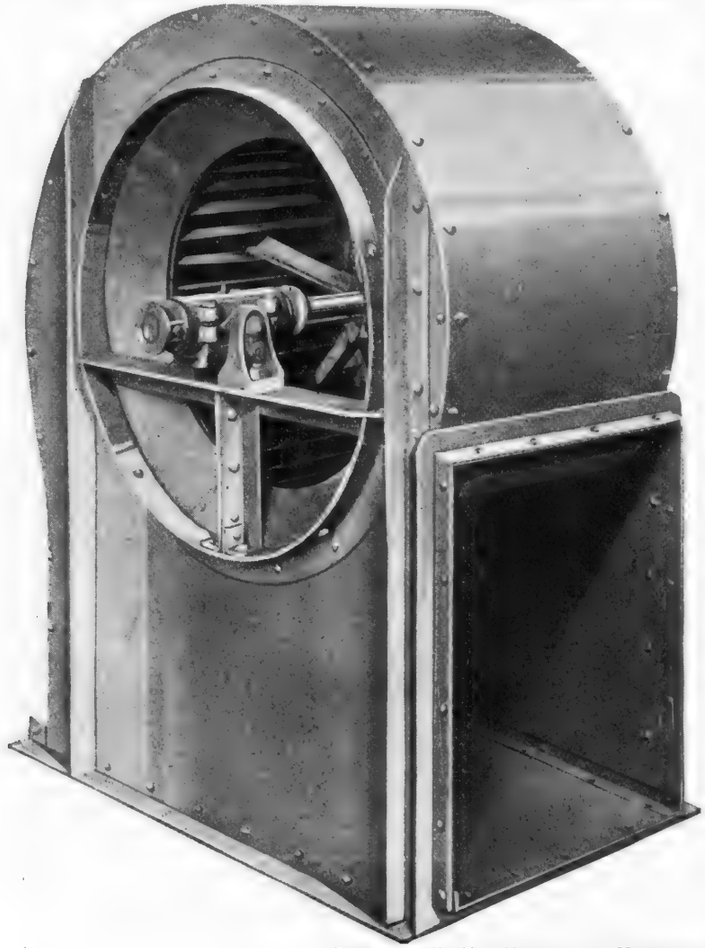
U. S. Boiler Compound Co., 180 No. Dearborn St., Chicago, Ill., incorporated to manufacture pipe and radiator cement, boiler compounds, etc. Incorporators: Marguerite Flack, Mary Fox and John L. Fox.

Van Denberg Supply Co., Rockford, Ill., capital $20,000, to manufacture, install and deal in heating, plumbing and sheet metal supplies. Incorporators: Harry S. Van Denberg, Alice E. Van Denberg and Donald E. Van Denberg. Offices have been opened on North Madison St.

The Needs of the Day as Expressed by the National Construction Conference.

How the construction industries view the present building situation is expressed very clearly in the resolutions adopted at the recent National Construction Conference, held in Chicago, March 2-3, at the instance of the National Federation of Construction Industries.

One resolution, for instance, starts out by stating that "whereas the public, due to conditions arising out of the



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are conservatively rated, giving that dependable assurance which means so much to careful Engineers, Contractors and Owners. You will find the same care is exercised in the manufacture of the product itself as is used in the compilation of the capacity tables.
When you want Fan satisfaction, specify

SERI-VANE FANS

THE NEW YORK BLOWER COMPANY
513 Transportation Building
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Factory: LaPorte, Indiana

Branch Offices in all large cities

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

New York Post Office Building

Equipped throughout with batteries of Massachusetts Fans

Massachusetts
Modified "Squirrel Cage" Fans

are especially adapted for heating and ventilating systems in Schools, Public Buildings, Factories, and Mills; the ventilation of Mines, Subways, Tunnels, Drying Systems, and on Board of Ship. This type of fan is used for all classes of work formerly done by the Steel Plate (or Paddle-wheel) type, but is not designed for moving materials such as shavings, wool, or grain, etc. "Squirrel Cage" Fans are made in standard sizes and capacities to meet every requirement for mechanical draft and for ventilation, whether or not in connection with heating.

MASSACHUSETTS BLOWER CO.
Watertown, Mass.

Branches in 20 principal cities throughout the country

war, is suffering from lack of homes, schools, hospitals, and all other classes of public and private construction; the construction industry, the largest next to agriculture, is virtually at a standstill, causing serious loss through unemployment and waste of overhead."

The resolution then goes on to state that "current costs of construction materials still remain much and erratically higher as compared with pre-war costs and compared with the average of all other commodities; current construction labor costs have not had proper readjustment to accord with present conditions; and practices and conditions surrounding financing of building construction require modification:"

The conclusion is reached in the resolution "that it is necessary to the revival of the construction activities that early steps be taken to inform the public fully as to the situation with respect to building materials. To that end, manufacturers, producers and distributors of building materials are urged to take such further deflation at this time as may be possible, and based thereon, to announce selling prices at which the public may be justified in having confidence," etc.

Also "that contractors, builders, employers and others interested are called upon to proceed promptly to the creation of a basis of labor costs which will be in conformity with present conditions and requirements, for the re-establishment of industry."

"You know, it's been rather quiet with you fellows over this way since the war was over and we have been rather favored in our little spot by having a good deal of activity, and so we have been fortunate enough to get visits from some of these Napoleons of construction and we have noticed that they are all very well versed on their hobby and that they can invade an architect's office with specious arguments and facts to prove that the only way that that owner can possibly conduct his operation is by doing business with them.

"In some cases they have convinced the owner of the logic of the position but I have yet to know a single owner that remained convinced when the operation was concluded."

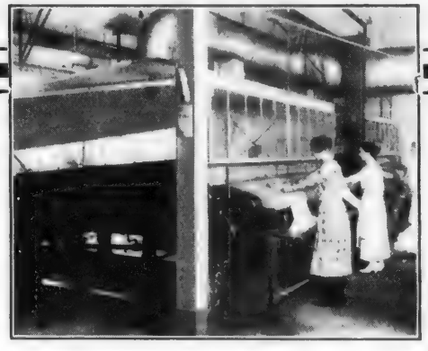
Looking at the matter from another point of view, William B. King, of the Bar of the Court of Claims, made the statement that if the cost-plus contract could generally be adopted, the risk in contracting would largely be eliminated. He admitted, however, that its uses are limited.

"It was the only possible form for much of the work during the war," he continued, "and it achieved splendid results. In spite of this, it fell into such popular disfavor that a recent official writer divides public opinion into those who have nothing to say about it, even by way of apology, and those who have everything to say about it that is objectionable. It can probably not be generally adopted for many years for public contracts with the United States, the states and municipalities, except under the most pressing necessity. It is doubtful whether it should be adopted until there is greater public confidence in public officers. It is susceptible of great abuse at the hands of a dishonest or inefficient government official.

"There is broad scope for its use in private contracts. This depends upon two factors; the first, that the owner has complete confidence in both the ability and the integrity of the contractor, and the second, that the owner is more concerned about having an excellent job than about the exact price.

"It changes the fundamental relation of owner and contractor. Under other forms of contract, the financial interests of contractor and owner as to excellence of workmanship and completeness of compliance with the specifications are on different sides of the situation; under a proper cost-plus system, they are on the same side. The contractor is the personal representative and adviser of the owner, corresponding to the position of the architect or engineer.

"Whether this extremely advantageous method of contracting comes into



Wing-Scruplex Exhausters constantly remove the heat and vapors from the ironing machines, making this laundry a very desirable place to work in.

Will Fit Any Job

Its convenient form—the housing being in the form of an elbow that will fit any duct system—is one reason why the

WING-SCRUPLEX EXHAUSTER
REG U.S. PAT. OFF.

will fit any job. Other reasons are many. Will handle hot, moist, greasy, dusty air without injury to any part of the equipment.

See where the motor is! Entirely outside the duct where it is easily accessible and will keep clean and cool.

Correct the fault at its source! Install the Wing-Scruplex Exhauster. On a job like the above, it takes the heat and moisture right away from the machine. Don't drag it a distance across the open room and then exhaust it out of a window, heating the entire atmosphere in the process, but convey it away through a duct, allowing the room to fill up with good, cool, fresh air.

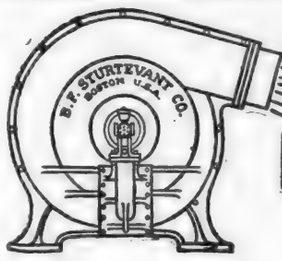
Write for Descriptive Bulletin 58-B

Fans and Blowers all Types

L. J. Wing Mfg. Co.

Damper Regulators Small Turbines

Hudson and 13th Sts. **New York City**



Sturtevant

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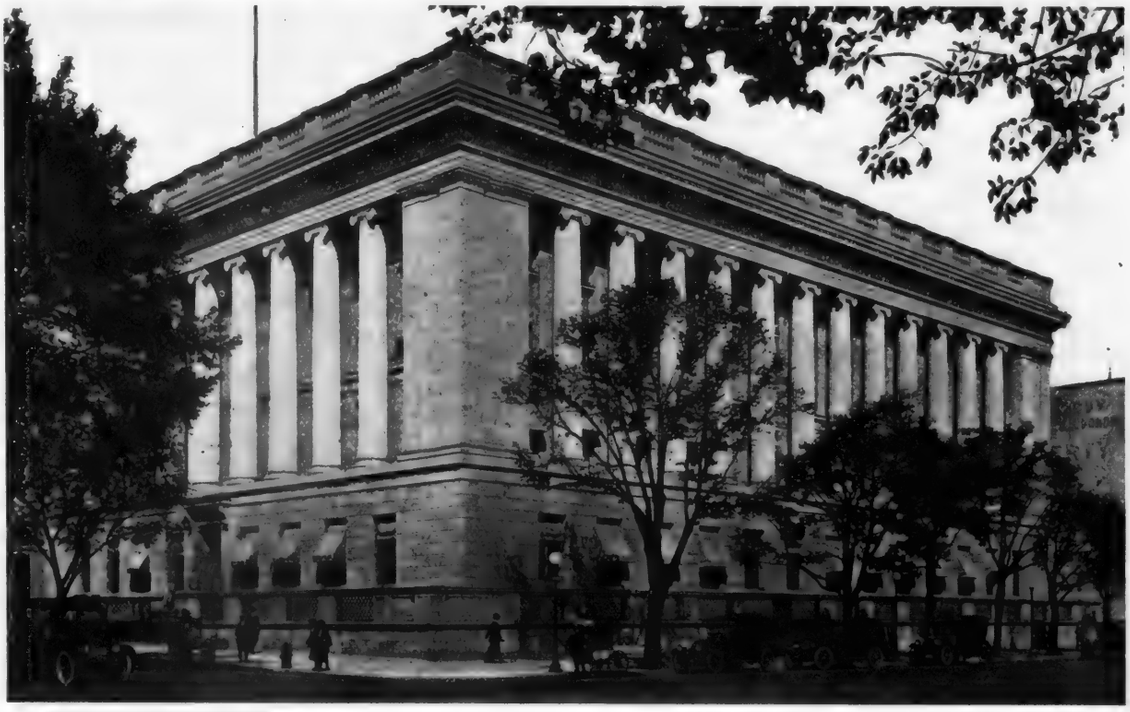
PUTS AIR TO WORK



U. S. Treasury Annex, Washington, D. C. *Cass Gilbert, Architect; D. E. Polglase, Mechanical Engineer*

EFFICIENT AND DEPENDABLE SERVICE

THE U. S. Treasury Annex recently completed at Washington is one-third of the building proposed for future needs. It is entirely a utilitarian structure and in the selection of materials and equipment long life and dependable service were the guiding factors.

Heating and ventilating were supplied by

STURTEVANT EQUIPMENT

You will generally find this true in all work, both large and small, where careful discrimination is used by engineers to obtain lasting satisfaction for the client, at a reasonable cost.

Expert engineering service and sixty years of practical experience justify your assurance of capable performance.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

STURTEVANT BRANCH OFFICES

ATLANTA, GA.
306 Walton Bldg.

BOSTON, MASS.
555 Mass. Trust Bldg.

BUFFALO, N. Y.
100 Bedford Ave.

CHICAGO, ILL.
530 So. Clinton St.

CINCINNATI, OHIO
604 Provident Bank Bldg.

CLEVELAND, OHIO
330 Guardian Bldg.

DALLAS, TEXAS
3411 Knight St.

DETROIT, MICH.
406 Marquette Bldg.

HARTFORD, CONN.
36 Pearl St.

KANSAS CITY, MO.
3830 Park Ave.

LOS ANGELES, CALIF.
411 Hollingsworth Bldg.

MINNEAPOLIS, MINN.
804 Met. Life Bldg.

NEW YORK, N. Y.
52 Vanderbilt Ave.

PHILADELPHIA, PA.
135 No. Third St.

PITTSBURGH, PA.
711 Park Bldg.

ROCHESTER, N. Y.
1024 Granite Bldg.

ST. LOUIS, MO.
2086 Railway Exchange Bldg.

SALT LAKE CITY, UTAH
818 McIntyre Bldg.

SAN FRANCISCO, CALIF.
759 Monadnock, Bldg.

SEATTLE, WASH.
1105-1106 White Bldg.

WASHINGTON, D. C.
1006 Loan & Trust Bldg.

B. F. STURTEVANT CO. OF CANADA, LTD.
GALT, ONT.

MONTREAL
404 New Birks Bldg.

TORONTO
210 Lumsden Bldg.

general use depends largely upon the confidence which individual contractors are able to inspire in the minds of owners, personal or corporate, and upon the recognition by owners that their greatest interest is in having the best building and paying a reasonable price for it.

"In doing this, the effort should be in favor of some form of cost-plus fixed fee, rather than cost-plus percentage. It will be much easier to establish the former than the latter."

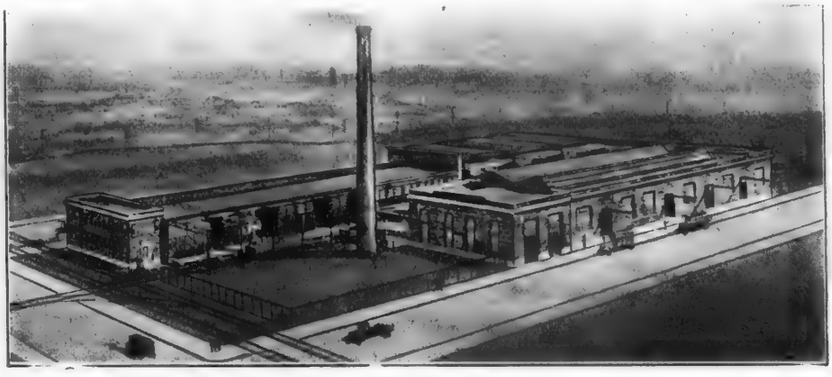
Another favorable view of the cost-plus form was taken by Judge Walter W. Warwick, comptroller of the United States Treasury, who said, among other things:

"I said something recently at a meeting about cost-plus contracts, and I have been asked to repeat it here. I did not advocate cost-plus contracts. In fact, it does not come in our line of business to advocate any particular form of contract, but I did say from my experience in examining vouchers and contracts made during the war that I had not seen any cost-plus construction contracts where I thought the contractor got the better of it. What I said was that the criticism in Congress and frequently in the public press against the cost-plus contract during the war and the statement that the more the contractor spent the more money he made and that he preferred to pay double the wages that were necessary in order to increase his profits, were not borne out by an examination of the contracts and the payments made under them."

New Plant for John Simmons Company.

One of the recent additions to the ever-growing industrial community of Long Island City, Queens, is the new plant of the John Simmons Co., of New York, for nearly fifty years a leader in its line as a supply house of wrought-steel and iron pipe, valves, fittings and steam specialties. The new location has been chosen especially to permit increased service. It has adequate railroad facilities and a siding on the premises.

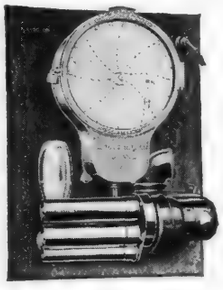
By using the Queensboro Terminal, located on the East River just south of the Queensboro Bridge, freight can be received or delivered each day for every transportation line in the United States, except the Pennsylvania system, which is in close proximity. This gives prompt and economical transportation and eliminates the necessity of carting to all the separate freight piers in Manhattan. In addition to increasing the shipping facilities by rail, the location lends itself to prompt deliveries within the metropolitan district.



NEW PLANT OF JOHN SIMMONS COMPANY IN LONG ISLAND CITY.

The new buildings comprise storage facilities for 1000 tons of pipe, mechanical department, pipe bending and

Indicating Tycos Temperature Instruments Controlling Recording



The *Tycos* Wet and Dry Bulb Recording Thermometer has proved its efficiency by exacting service. No matter what conditions surround its application, proper functioning is certain.

Recording Hygrometer

Other Tycos Instruments useful in the satisfactory handling of heating and ventilating problems are:

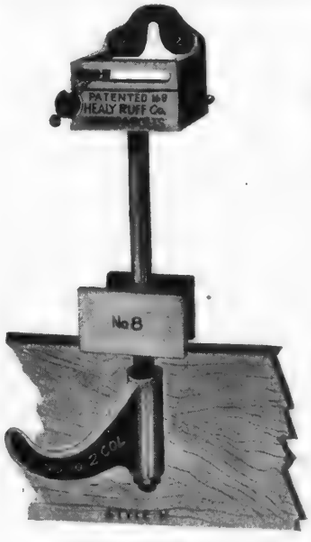
Angle and Straight Stem Thermometers
Air Duct Thermometers
Hygrometers
Index Thermometers
Recording Thermometers
Barometers
Temperature and Pressure Regulators

400-page catalog sent without obligation to executives and engineers who designate their official position with their firms.

Taylor Instrument Companies
Rochester, N, Y,

There's a Tycos or Taylor Temperature Instrument for every purpose.

751



Style H

Style R

The E Z Radiator Hangers

have all the adjustments needed and they sell at a very reasonable price

Write for Bulletins

Healy Ruff Company
MANUFACTURERS
Minneapolis, Minn.

SEE OUR CATALOGUE IN SWEETS

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Westinghouse
Ventilating Equipment
in the
INDUSTRIAL PLANT

W
WESTINGHOUSE ELECTRIC

Westinghouse engineers have specialized in the design of high grade equipment for ventilating work

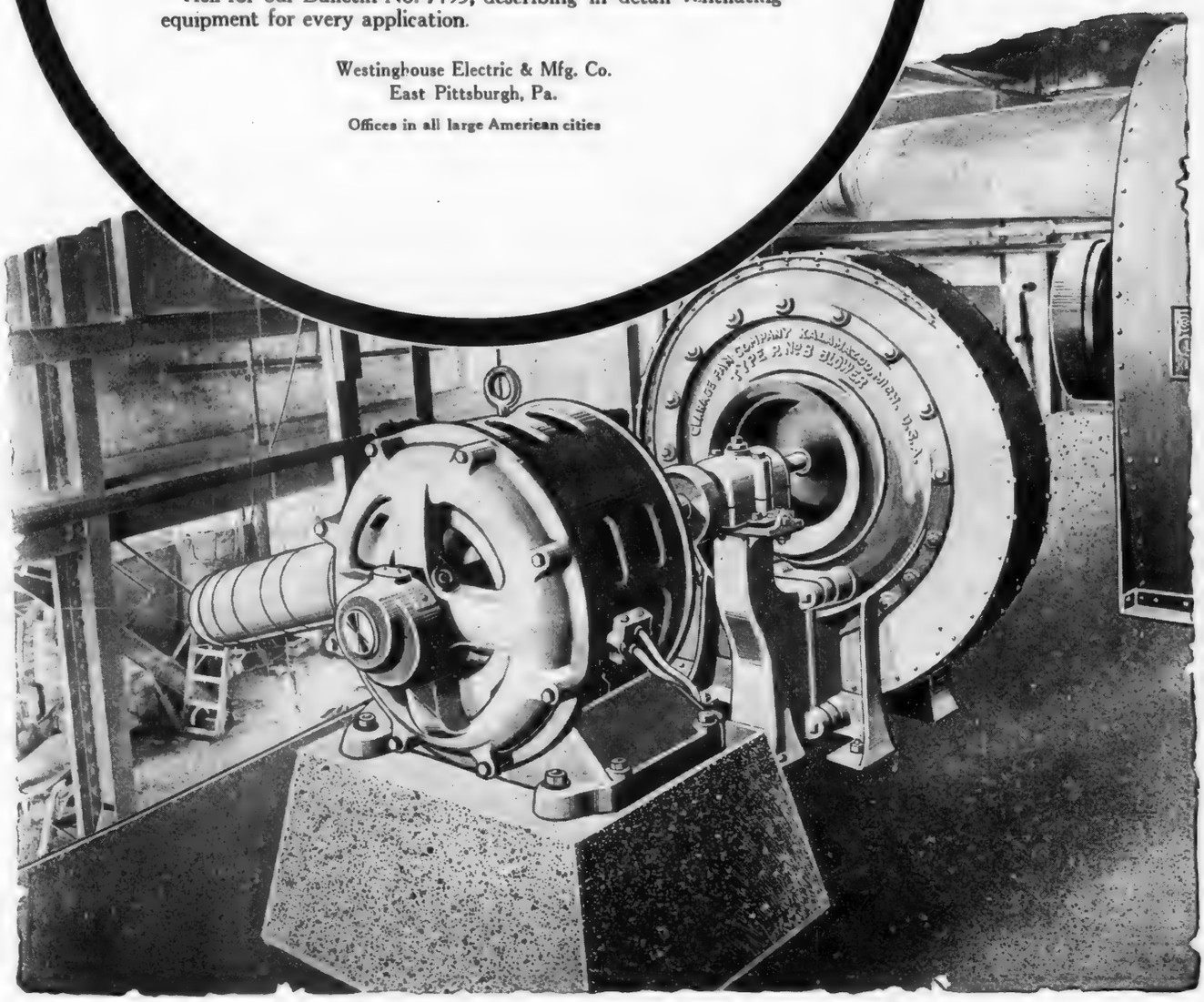
Motors and controllers have been designed for ventilating service in factory, home or school.

Big hotels, such as the Pennsylvania, in New York, and many factories and schools all over the country, are using this equipment and running it continuously day and night with practically no care or attention.

Ask for our Bulletin No. 7193, describing in detail ventilating equipment for every application.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Offices in all large American cities



blacksmith shops and office. Ample space has been left for possible future expansion.

The company's general executive offices, sales, export and fire equipment departments will remain in the present quarters at 110 Center Street, Manhattan, while the plumbing supply department will be maintained at the Bush Terminal warehouse.

Important Contract Let in New Jersey.

One of the largest building contracts let in several months in New Jersey and one which attracted an unusual number of bidders, is that for the Psychiatric Reception Hospital buildings in Morris Plain, N. J. An appropriation of $800,000 for this building was made by the State legislature, while the total of all the low bids came to less than $600,000.

The plans for the hospital were drawn by L. F. Pilcher, New York State architect, who was especially retained for the work, the mechanical equipment being designed by George B. Nichols.

The large number of bids received is taken as an indication of the improvement in building conditions generally, while the prices themselves are considerably below those of the peak period. The cost, for instance, per cubic foot, including all mechanical equipment, with elevators, etc., came to 38 cents, while many of the preliminary estimates were about 55 cents.

No less than twenty bids were received for the heating of the hospital, nineteen for the electrical work, and ten for the sanitary equipment; those for the general construction totaled seventeen, the lowest being that of Franklyn-Harris Co., Philadelphia, amounting to $444,307. The low bid for the heating work was submitted by George J. Tobin, $33,449. Other bids were: Mechanical Equipment Co., $34,500; J. H. Wells, $35,713; Steward & Ferard, $36,267; J. H. Cooney, $37,949; E. G. Wolfert, $38,748; Austin Engineering Co., $39,274; Almirall & Co., $39,525; E. W. Tompkins & Co., $39,742; J. C. Williams, $39,974; Janigs & People, $40,281; Fred S. Mertle, $40,524; G. E. Engineering Co., $44,924; Ryan Plumbing & Heating Co., $47,400; Chas. H. Darmsted Co., $47,985; John R. Proctor, $48,763; Walter P. Dunn, $49,887; Walker & Chambers, $49,960; Globe Auto Sprinkler Co., $50,225; A. B. Barr & Co., $51,620. The lowest bidder for the sanitary equipment was Janigs People & Co., Inc., ($39,857), while the lowest bidder for the electrical work was Watson Flagg Engineering Co. ($10,200).

The Temperature-Control System in the Cleveland Hotel.

Due to an error in our wording of the advertisement of The Bishop & Babcock Co., of Cleveland, published in The Heating and Ventilating Magazine for March, it was made to appear that the B. & B. temperature-control system was used in the equipment of the Cleveland Hotel, in Cleveland. As is well-known, the Johnson system of temperature-control, manufactured by the Johnson Service Co., Milwaukee, Wis., was used in this particular building. The foregoing is published at the request of The Bishop & Babcock Co., who very properly state that "we do not want our advertisements to be misleading in any way and we want credit only for the buildings in which we installed our material, and do not wish to receive credit for installations other than those where our material has been used exclusively."

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceeding date of issue.

Wanted—Good line of boilers and radiators to sell on commission basis from well-established office in Newark, N. J., and central New England. Address Box 41, care of Heating and Ventilating Magazine.

CONNERSVILLE VACUUM CLEANING SYSTEMS

East Ohio Gas Co. Office, Cleveland

Connersville equipped buildings are always clean, because

—correctly designed tools make for rapid as well as thorough cleaning,

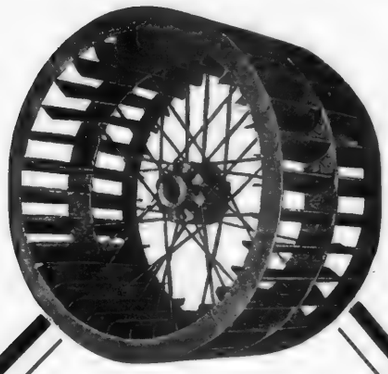
—the large volume of air combined with sufficient vacuum picks up heavy dirt from bare floors as well as carpets.

—the extreme durability of the equipment eliminates shut-downs for repairs.

Connersville vacuum cleaners are made with standard dry type separators or direct sewer discharge type. No building is too large to be cleaned the Connersville way.

LANDERS, FRARY & CLARK, U. V. A. DIV. DEPT. C. CONNERSVILLE, IND.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*



Bayley

PLEXIFORM FANS

furnish efficient ventilation at a minimum of power required, a low first investment and at a greatly reduced space requirement. They are accurately balanced, run in ring-oiling bearings, and every part is easily accessible in case repairs or adjustments become necessary.

Chinook Heaters

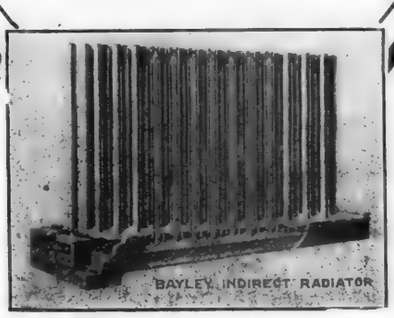
are built on the tube within a tube principle, free from "U" joints as shown by the illustration below. This makes repairs or replacements easy, and makes it possible to ship radiators K. D., thus saving freight and breakage.

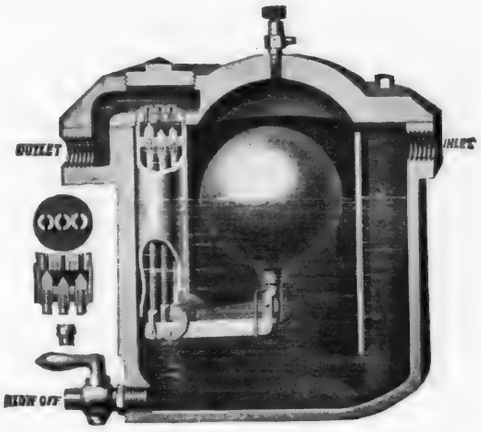
Engineering Service

The service of our engineering staff consisting of men who have made a life study of heating and ventilating problems, are yours for the asking.

BAYLEY MFG. CO.

Milwaukee, Wis.





Assures Dry Steam

The Wright "Emergency" 3-valve High-Pressure Automatic Continuous Flow Steam Trap increases the efficiency of heating equipment because it drains all accumulated condensation from steam lines, and does it without steam waste.

The "Emergency" Trap is but one of the Wright-Austin "steam-savers" which are guaranteed and are installed on trial.

Send for a copy of our catalogue which completely describes the Wright-Austin Steam Specialties.

WA
Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN COMPANY

Detroit, Mich., U. S. A.

Branch Offices:

New York **Boston** **Chicago**

Representatives Everywhere

(17)

WANTED.

A large heating and ventilating company in New York City offers an opportunity to a high-class experienced engineer who has a through knowledge of air conditioning and humidifying systems.

All applications will be considered strictly confidential. Only those who have had actual experience as engineers in air conditioning work and some of its new applications need apply.

An unusual opportunity is offered to the right man.

CONFIDENTIAL, Box 58, Care of Heating and Ventilating Magazine.

Heating and Ventilating Salesmen—If you can qualify as a good salesman for our Products, we have an excellent opportunity for you. Have you an acquaintance with architects, engineers and contractors—have you sold heating and ventilating systems? If so, you can capitalize your acquaintance and experience. We have a proposition that is equivalent to putting you in business for yourself.

Moline Heat Salesmen who have been operating for years, will furnish sufficient evidence of the possibilities. You need not be a technical engineer, so long as you know the fundamentals of good heating and ventilating and are a good salesman.

The Univent is now becoming recognized by leading Architects and Engineers as the greatest step in modern ventilation. It is now being specified for Schools and Public Buildings from Maine to California.

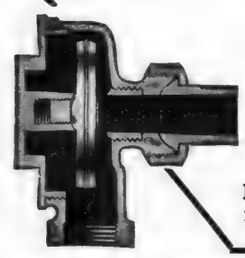
Also manufacturers of the well-known Moline System of Steam Circulation on the market for the past fourteen years and in many parts of the country is well known and widely used by leading Architects and Contractors; also manufacturers of other products identified with heating and ventilating. See our advertisement on pages 12-13.

Write at once as territory is fast closing up. Moline Heat, Moline, Ill.

The "IDEAL" Trap

IN NAME - IN PRINCIPLE - IN SERVICE

For all Return Line Heating Systems—Vapor, Vacuum or Straight Steam



1. Fool Proof.
2. Less Complicated.
3. A "Protected" Diaphragm.
4. Vertical Self Cleaning Seat.
5. Highest Radiator Efficiency.

Ideal Heating Equipment Co.
1897 E. 90th St. Cleveland, Ohio

STERLING SYSTEMS

STERLING SYSTEMS

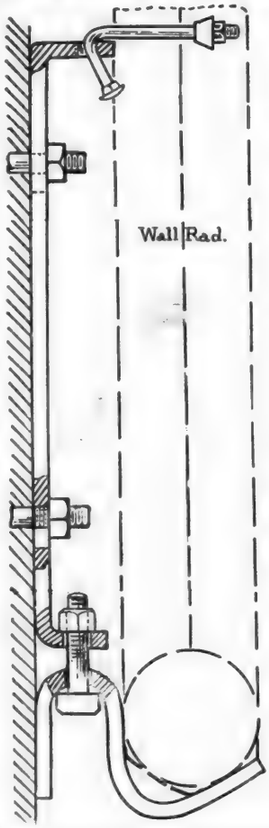
Vacuum and Vapor Heating Specialties

Thermostatic Traps—Air Line Valves—Graduated Supply Valves—Air Eliminators—Damper Regulators—Return Traps

STERLING ENGINEERING COMPANY
Milwaukee Wisconsin

GLEOCKLE WALL RADIATOR BRACKET

(Patented)



Possesses Advantages of

Universal Adjustment

Ease of Erection

Made of Wrought Iron

Unbreakable

Rustless

Fitting all Makes of Wall Radiators

Available for Immediate Shipment

Write for Descriptive Booklet and Trade Discounts

A. F. Gleockle, Jr.
415 Bay St.
ROCHESTER, N. Y.

SETTING-UP

an Air Washer

IN MEL-ROCK AIR WASHERS the Eliminator Plate system is built in batteries at the factory.

Setting up and taking down are a simple process, saving time and money.

MEL-ROCK MIST NOZZLES discharge a greater volume of mist at low pressure. They cannot clog, and have no adjustments.

Each capacity of MEL-ROCK AIR WASHER comes in from 4 to 7 different sizes and proportions, so that any space or head room may be accommodated.

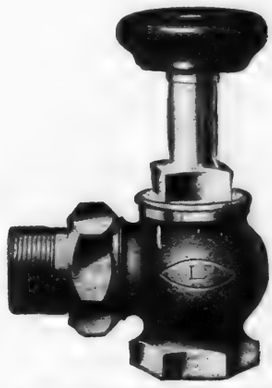
Send for new descriptive catalog

MEL-ROCK PRODUCTS TRADE-MARK

MELLISH-HAYWARD COMPANY
213 W. Austin Av.
CHICAGO

LAVIGNE

PACKLESS QUICK--OPENING STEAM RADIATOR VALVES



Lavigne Packless Wood Wheel Handle

have been tested by a great many years of strenuous service and the engineering principles involved in their construction have been proven absolutely correct.

These valves Positively do not leak air, water or steam Open quickly and close just as quick. Are correctly proportioned and properly manufactured.

BUILT RIGHT———TO STAY TIGHT

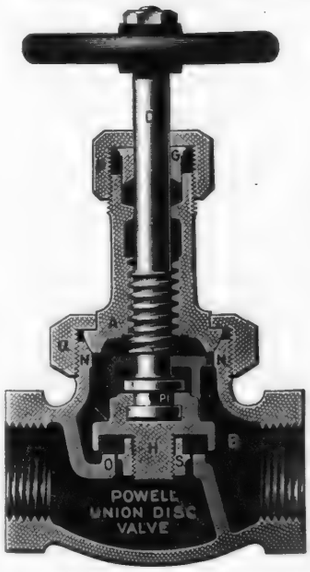
Made in six sizes, many styles of handles--
All good jobbers handle them

COMMONWEALTH BRASS CORPORATION DETROIT, MICH.

POWELL VALVES

Union UNION COMPOSITE DISC VALVE Disc

For Steam, Gas, Oil or Air



Notice the Union Bonnet Connection

Steam Bronze Composition Body and Trimmings

Vulcanized Composition, White Metal or Bronze Discs

Screwed or Flanged Ends

Ask for

POWELL UNION DISC VALVES

THE WM. POWELL CO.
CINCINNATI, OHIO

MARSH

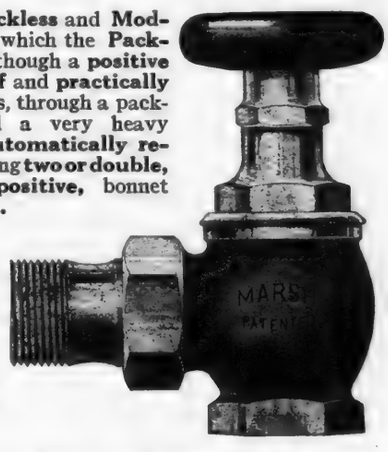
RE-ENFORCED PACKLESS

VALVES

Quick Opening

Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically re-enforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**



These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

MARSH VALVE CO., Erie, Pa.

Banner Rock Wool Quilt
100% Fire Proof

INSULATION
FOR
HOT SURFACES

Cut shows typical installation of Banner Rock Wool Quilt on Boiler of Apartment House after 4 Years' Service

DISTINCT ADVANTAGES.

1 MOST EFFICIENT (by Government tests)
2 EASE OF APPLICATION
3 FLEXIBILITY
4 CAN BE TEMPORARILY REMOVED TO MAKE REPAIRS
5 LOWEST INITIAL COST

"More Insulation for Money Invested"

Send for Information

Banner Rock Products Co.
Alexandria, Ind.

Alberger

Buffalo Multi-Head Heaters

For forced and gravity circulation heating systems. Installed for such firms as Ford Motor Company, Lincoln Motor Company, American Woolen Mills, Fisher Ohio Body Company, American Can Company, U. S. Government and many others.

Write for Catalog No. 3

ALBERGER HEATER CO.
Buffalo, N. Y.

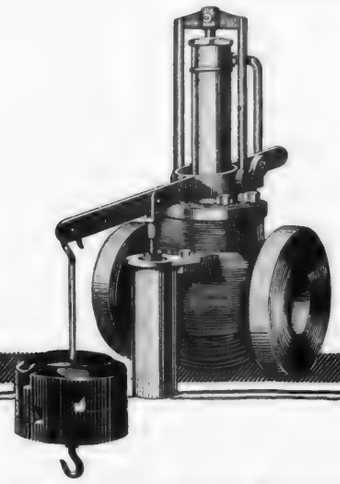
You Need This Portable Power Drive

EVERY plumbing or steam-fitting contractor who has watched a "Toledo" Drive at work, has been amazed at its simplicity—its utility—its speed—its ease of operation and its economical upkeep. No drive for portable pipe tools can compare with the "Toledo" for all-around excellence. You need one. Write for details.

The Toledo Pipe Threading Machine Co., Toledo, O.

N. Y. Office:
50 Church St.

TOLEDO DRIVE
PORTABLE POWER



You can Rely on Davis Regulators—

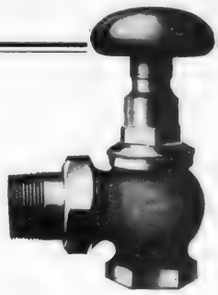
Davis Regulators are reliable—once set, they will maintain any reduction in pressure regardless of fluctuations in demand or in supply.

The Davis Regulator is as certain as gravity because gravity-controlled by weighted lever arm—no packing—no springs or diaphragm to get out of order.

The Davis catalog explains in detail the certainty of operation and simplicity of action of the Davis Regulator. It also describes the complete line of Davis valve specialties for the automatic regulation of pressure. Every heating engineer, steamfitter and architect should have a copy. Shall we send yours?

G. M. Davis Regulator Company
436 Milwaukee Ave., Chicago

DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875



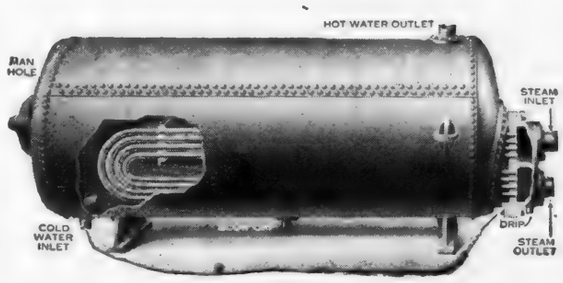
"Genuine Detroit" Packless Radiator Valves

Detroit Packless Radiator Valves are the result of years of experience in the valve manufacturing field—of a careful study of valve needs—of painstaking care on the part of our engineers.

So well do these valves qualify for efficient service—for handsome design and pleasing appearance—for complete satisfaction, that leading architects, heating engineers and master builders, the country over, recommend and specify them for jobs that require the most careful consideration.

They are made for steam, vapor and vacuum heating systems—in all necessary sizes and a variety of styles. Let us send booklet giving full information.

DETROIT LUBRICATOR COMPANY.
DETROIT, U.S.A.



The Patterson System of Water Heating

means no variation, no adjusting, no attention whatever.

It is automatic, uniform in temperature and in the flow of **hot water.**

It is instant, ample, flexible and reliable.

It saves coal, time and money, and insures evener, better results.

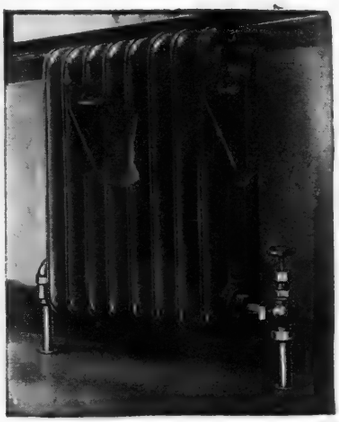
All these features mean more profits—more money in the pockets of the users.

That's why they use it!

Maybe our engineers can help you recommend.

Patterson-Kelley Co.
23 Dey St. New York

HARTMANN
RADIATOR BRACKETS



WHYS

LABOR SAVED
NO WALL STRIPS
NO BREAKAGE
NO DIRT
INEXPENSIVE

Send for descriptive circular and price list

CHARLES HARTMANN CO.
SHEET METAL CONSTRUCTORS
985 Dean St., Brooklyn, N. Y.

Every Heating Engineer Knows the Advantages of Copper Over Iron

SPECIFY

DAHLQUIST

Copper Boilers

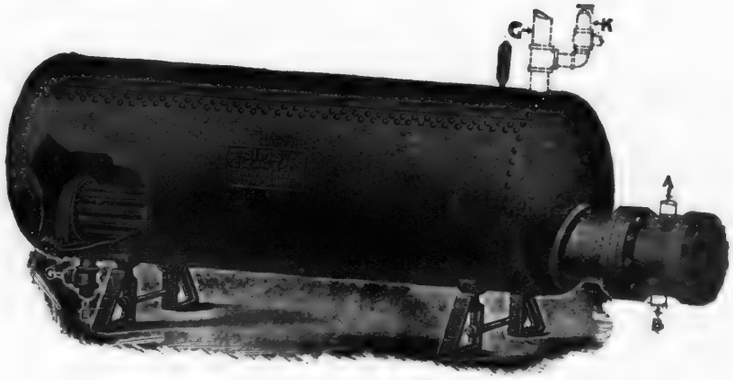
Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

Meet that Peak Demand for Hot Water

WITH A

Sims Clean E-Z Steam Tube Heater



For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings, Schools, etc.

For Live or Exhaust Steam

Especially Designed for Supplying Large Quantities of Hot Water

Send for tables showing heat capacities using steam at various pressures

"We keep others in hot water"

THE SIMS CO., 18th St., Erie Pa.

AIR CONDITIONING TRADE MARK

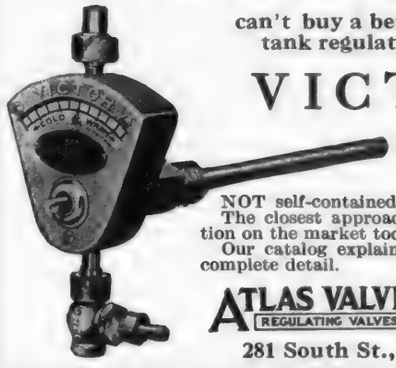
APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA

$1,000,000,000

can't buy a better hot water tank regulator than the

VICTOR



NOT self-contained.
The closest approach to absolute perfection on the market today.
Our catalog explains how and why in complete detail.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South St., Newark, N. J.

Ross

Surface Barometric and Jet Condensing Equipments for Power Plants. Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service. Distilling Condensers for Refrigeration and Chemical Plants.

"Crosshead Guided" Expansion Joints.
Ross Boiler Feed Water Heaters.
Ross Oil and Sugar Juice Heaters.
Gravity & Forced Circulation Heaters.
Ross Oil, Air and Water Coolers.

ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

PECO

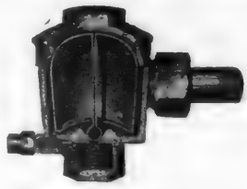
"The System with a Record"

Over thirty plants "Pecoized" for one company

20% to 40% fuel saving

Let us talk over your condition with you

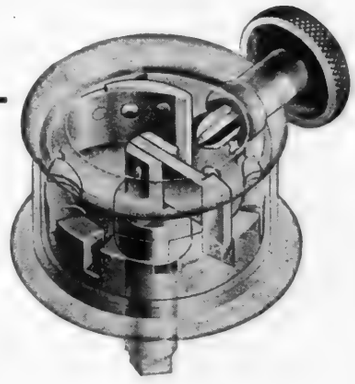
The Fool-Proof Valve



Non-adjustable
Positive in action

Catolog on request

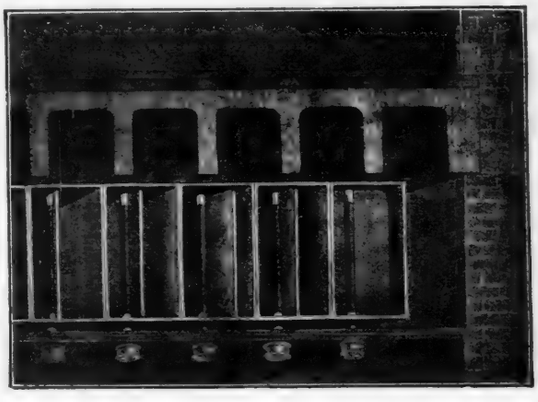
PITTSBURGH ENGINEERING CO.
Mfrs. Peco Vacuum System of Steam Heating and Drying
JEANNETTE PENNSYLVANIA



This is the Key to Good Ventilation

THE PERFECTO DAMPER REGULATOR AND INDICATOR

when placed on a battery of ducts in the collecting chamber near the machinery room, not only affords an easy and convenient means of regulating the flow of air, but also serves as a positive means of indicating the room to which each duct leads, by means of the numbered or lettered cover windows.



Let us send you further particulars

The Sixth City Sheet Metal Works Co.
Cleveland, Ohio
Office and Factory, 1830 St. Clair Avenue

Automatic Condensation Pump and Receiver

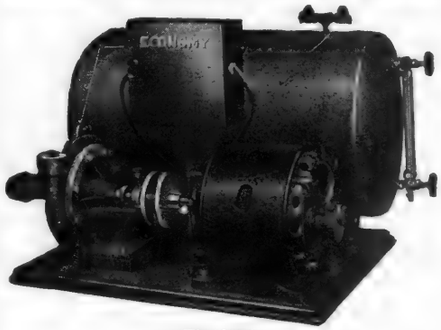


Fig 2176.
HAVE YOU MANUAL B? IT'S FREE.

Now is the Time to Make Friends Better Friends

Show them how to save money while enjoying greater comfort, for it is a recognized fact that coal will cost more than ever before. It is also a fact that a heating system is greatly improved by using an ECONOMY PUMP AND RECEIVER while the coal bill will be materially reduced by its use.

Their Promotion Will Yield a Handsome Profit

We have one customer who hesitated at buying the first pump. He has bought over fifty since. Each one tends to sell another, pyramiding your profits.

ECONOMY PUMPING MACHINERY CO.
120-126 North Curtis Street, Chicago, Ill.

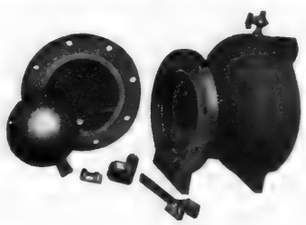
Why You Should Specify and Use the Corliss Valve Steam Trap

A summary of the important features that appeal to the discriminating engineers who insist and rely upon the

CORLISS VALVE STEAM TRAP

It is designed by engineers for engineering service.
Is simple in construction—has only six parts.
Absolutely automatic and continuous in operation.
Pressure on top of valve and steam cannot touch it.
The valve is only moving part—never leaves its seat.
No wire drawing; no stuffing boxes; no packing.

Insured Against Maintenance



By an Iron-clad Guarantee

In selecting steam traps on an engineering basis, the choice always narrows down to the Corliss Valve Trap. Even on a dollar and cents basis the Corliss Trap is the best buy when full capacity positive operation and the saving in maintenance are considered.

Specification and Data Sheet on request

PLANT ENGINEERING AND EQUIPMENT CO. INC.
192 Broadway New York, N. Y.

Our New "L" Type BILGE PUMP

Heavy duty—large shaft and bearings.

Oil immersed, radial-thrust ball bearing.

Pump can be removed without disturbing automatic apparatus on basin cover.

DRAINAGE INSURANCE

means a good pump in the cellar.

It insures a dry basement and freedom from grief. A poor one is worse than useless—insures perpetual worry. What if a good pump does cost just a little more? It saves the difference in the first emergency.

The Wise Contractor uses the best equipment he can get. And thereby escapes the "COME-BACKS."

BE A WISE ONE

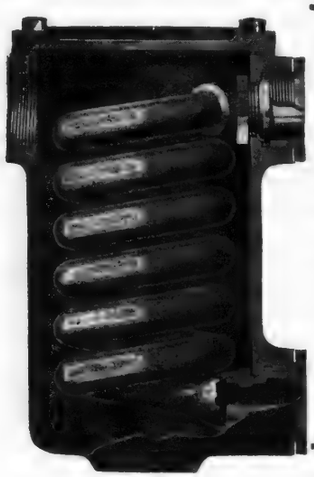
Profit by our life-time of specialized experience.

Ask for Our New Catalog

It tells all about our other products—

Sewage Ejectors, Condensation Pumps, Return Line Vacuum Pumps, Turbine House Pumps, Hot and Cold Water Circulating Pumps.

CHICAGO PUMP COMPANY
2325 Wolfram St. Chicago, Ill.



The New Excelso Water Heater

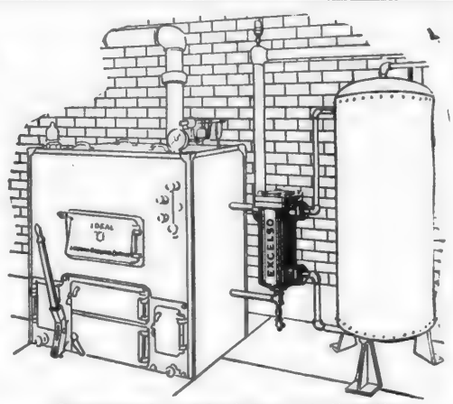
Eliminates Fire-Pot Pipe Coils

The Excelso Heater, connected below the waterline of steam or vapor boilers, will generate domestic hot water constantly, day and night, as long as there is any fire, at practically no cost.

The copper coil is connected into heater without packing. Made in five sizes for tank capacities as follows:

No. 11	No. 12	No. 13	No. 14	No. 15
30 gal.	45 gal.	70 gal.	90 gal.	120 gal.

EXCELSO SPECIALTY WORKS
119 Clinton St. Buffalo, N. Y.



Connected to Ideal Type "A" Boiler

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

WHITLOCK

HEATERS *for* { Feed Water, Domestic Water Supply, Process Water, Fuel Oil, Juice or any fluid.
Using Steam, Hot Water or Exhaust Gas.

COOLERS *for* { Surface Condensers for Steam or other Vapors.
Heat economizers for condensation or exhaust gases.
Cooling Lubricating or Hardening Oil.

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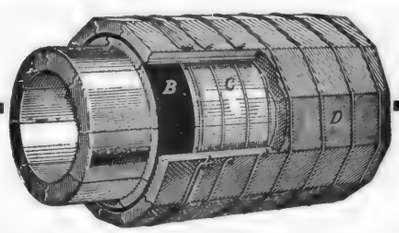
Hartford New York Philadelphia Boston Buffalo

Agents in all Principal Cities



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C—Dead Air Space.
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Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

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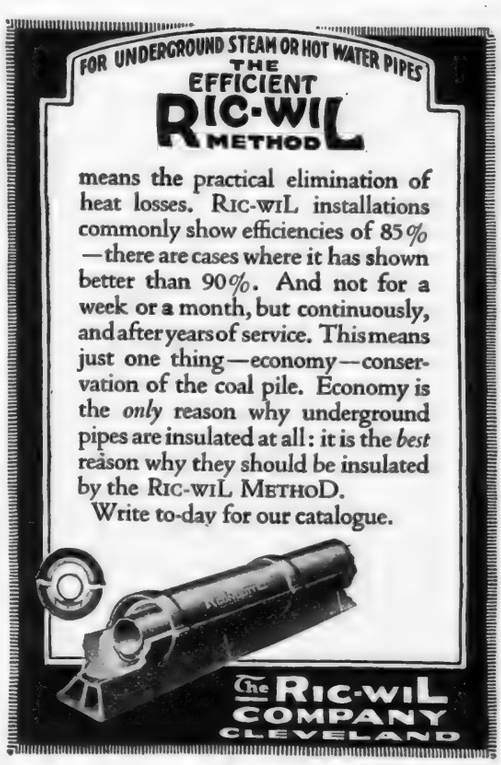
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RIC-WIL METHOD
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Write to-day for our catalogue.
The RIC-WIL COMPANY
CLEVELAND

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.

Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.

AIR CONDITIONING APPARATUS.

American Blower Co., Detroit, Mich.
American Ventilating Co., Pittsburgh, Pa.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLERS.

Alberger Heater Co., Buffalo, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.

AIR COOLING AND DRYING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo,, N. Y.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Hersh & Bros., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.

Jas. P. Marsh & Co., Chicago, Ill.

AIR SEPARATORS.

Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Hersh & Bros., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Mellish Hayward Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

BLOWERS.

Fan.

American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hackney Mfg. Co., St. Paul, Minn.
Hersh & Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Pressure.

American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Buffalo, Forge Co., Buffalo, N. Y.
Connersville Blower Co., Connersville, Ind.
Hersh & Bro., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.

Connersville Blower Co., Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

Turbine.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Plant Eng'g& Equipment Co., New York.
L. J. Wing Mfg. Co., New York .

BOILER BREECHINGS.

Hartmann Co., Charles, Brooklyn, N. Y.

BOILERS.

Copper.

Dahlquist Mfg. Co., Boston, Mass.

Heating.

American Radiator Co., Chicago, Ill.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co. Utica, N. Y.
Page Boiler Co., Wm. H., New York.
Utica Heater Co., Utica, N. Y.

Down-draft.

American Radiator Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York.
Utica Heater Co., Utica, N. Y.

CALORIMETERS.

Sarco Co., New York.
Schaefer & Budenberg Mfg. Co., Brooklyn, N. Y.

COILS, PIPE.

Simmons Co., John, New York.

Air.

New York Blower Co., Chicago, Ill.

CONTROLLERS, BOILER.

Kelly Controller Co., Chicago, Ill.

COOLERS.

Oil.

Griscom-Russell Co., New York.

CONDENSERS.

Alberger Heater Co., Buffalo, New York.
Alberger Pump & Condenser Co., New York.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS, HOT WATER.

Patterson-Kelley Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

COVERING, PIPE.

American District Steam Co., No. Tonawanda, N. Y.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville Co., H. W., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.

Sixth City Sheet Metal Works, Co., Cleveland,O

DEHUMIDIFYING APPARATUS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Philda., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleischer Co., New York, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DISTILLERS.

Water.

Griscom-Russell Co., New York.

DRYING SYSTEMS.

(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DUST COLLECTORS.

Atmospheric Conditioning Corp., Phila., Pa.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.

DUST DETERMINATORS.

Atmospheric Conditioning Corp., Phila., Pa.
E. Vernon Hill Co., Chicago, Ill.

ECONOMIZERS, FUEL.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EQUALIZING LOOPS

Hoffman Specialty Co., New York.

EXHAUST SYSTEMS.

Hartmann Co., Charles, Brooklyn, N. Y.

ENGINES.

Steam, Automatic.

American Blower Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.

American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EVAPORATORS.

Boiler Feed Make-up.

Griscom-Russell Co., New York.

EXHAUST HEADS.

Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons, Co., John, New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wright-Austin Co., Detroit, Mich.

EXPANSION JOINTS.

Alberger Pump & Condenser Co., New York.
American District Steam Co., No. Tonawanda, N. Y.
Badger & Sons, E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Century Conduit Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Co., New York.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

FANS, EXHAUST.

American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hackney Mfg. Co., St. Paul, Minn.
Hersh & Bro., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co,. New York.

FILTERS.

Aerating.

Griscom-Russell Co., New York.

Feed-water.

Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

FLANGES.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., N. Y.

FUELSAVING DEVICES.

Sabin & Co., Inc., Fred'k., Philadelphia, Pa.

GASKETS, METALLIC.

Sarco Co., New York.

GAUGE BOARDS.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.

Draft.

American Steam gauge & Valve Mfg. Co., Boston, Mass.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Hydraulic.

Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Ounce Graduated.

Jas. P. Marsh & Co., Chicago, Ill.

Pressure.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum.

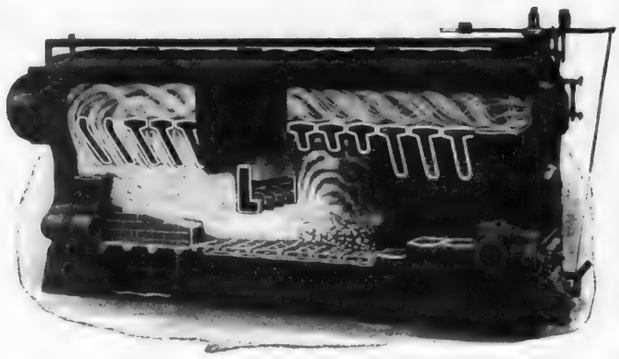
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Water.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American District Steam Co., No. Tonawanda, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.

GENERATING SETS.

American Blower Co., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



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EACH winter, thousands of building owners resolve to install new boilers as soon as weather conditions permit. This winter has been no exception. Enormous fuel prices have staggered the owners thruout the country and now is your opportunity to sell them on Imperial Super-Smokeless Boilers.

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Utica Heater Company, Utica, New York

210-220 West Kinzie Street, Chicago, Ill.

Imperial Super-Smokeless Boilers

ENGINEERS' SPECIFICATION INDEX (Continued).

GENERATOR COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.

GOVERNORS, PUMP.

Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Plant Engineering & Equipment Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

HEATERS.

Domestic Water.

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Dahlquist Mfg. Co., Boston, Mass.
Excelso Specialty Works, Buffalo, N. Y.
Patterson-Kelley Co., New York.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Closed).

Alberger Heater Co., Buffalo, N. Y.
Alberger Pump & Condenser Co., New York.
Griscom-Russell Co., New York.
Kelly Controller Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims, Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Open).

Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.

Griscom-Russell Co., New York.

Pipe Coil (Air).

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HEATING SYSTEMS.

Unit Blast.

American Blower Co., Detroit, Mich.
BattermanTruitt Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Unit Air.

Moline Heat, Moline, Ill.

Gravity and Forced Circulation, Water.

Alberger Heater Co., Buffalo, N. Y.

Vacuum.

Dunham Co., C. A., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Vapor.

American District Steam Co., No. Tonawanda, N. Y.
Dunham Co., C. A. Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago. Il.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Moline Heat, Moline, Ill.
Sarco, Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HUMIDITY CONTROL.

Atlas Valve Co., Newark, N. J.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.

HYGROMETERS.

Jas. P. Marsh & Co., Chicago, Ill.
Taylor Instrument Cos., Richester, N. Y.

INSTRUMENTS.

Electric Measuring.

Cleveland Instrument Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.

Cleveland Instrument Co., Cleveland, O.
E. Vernon Hill Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Sarco Co., New York.
Sixth City Sheet Metal Works Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Banner Rock Products Co., Alexandria, Ind.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville Co., H. W., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Weatherstrip Manufacturers' Association.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.

American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

METERS.

Condensation.

American Dist. Steam Co., No. Tonawanda,
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.
Plant Engineering & Equipment Co., New York.

Feed Water.

Central Station Steam Co., Detroit, Mich.
Simmons Co., John, 110 Center St., New York.

(Feed Water (Wier Type).

Webster & Co., Warren, Camden, N. J.

Pitot Tube.

American Blower Co., Detroit, Mich.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Steam.

American District Steam Co., No. Tonawanda, N. Y.

MOTORS.

Electric..

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

OIL BURNERS.

Cleveland Gas Burner & Appliance Co., Cleveland, O.

OZONATORS.

Ozone Pure-Airifier Co., Chicago, Ill.

PAINT, FOR HEATED SURFACES.

Ric-Wil Co., Cleveland, O.

PIPE.

Soil.

Simmons Co., John, 110 Center St., New York.

Steel.

Simmons Co., John, 110 Center St., New York.

Wrought Iron.

Simmons Co., John, 110 Center St., New York.

Wood.

Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.

Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, WOOD.

American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE HANGERS.

Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE CUTTING AND THREADING MACHINES.

Crane Co., Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.

PIPING, POWER.

Crane Co., Chicago, Ill.
Simmons Co., John, New York.

POWER PLANT SUPPLIES.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Johns-Manville Co., New York.
Plant Engineering & Equipment Co., New York.
Simmons Co., John, New York.

PUMPS.

Boiler Feed.

Advance Pump & Compressor Co., Battle Creek, Mich.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Plant Eng'g & Equipment Co., New York.
Yeomans Bros., Chicago, Ill.

Centrifugal.

Alberger Pump & Condenser Co., New York.
Allenclif Engineering Co., Columbus, O.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.
Thomas Pump Works, New York.
Yeomans Bros. Co., Chicago, Ill.

Condensation.

American Steam Pump Co., Battle Creek, Mich.
Allenclif Engineering Co., Columbus, O.
Chicago, Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump works, New York.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Yeomans Bros. Co., Chicago, Ill.

Rotary.

Connersville Blower Co., Connersville, Ind.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump Works, New York.
Thompson Mfg. Co., Des Moines, Ia.
United Vacuum Appliance Division, Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam.

Advance Pump & Compressor Co., Battle Creek. Mich.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.

Turbine.

Alberger Pump & Condenser Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.
Yeomans Bros., Chicago, Ill.

Vacuum.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Connersville Blower Co., Connersville, Id.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros., Chicago, Ill.

PYROMETERS.

Cleveland Instrument Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RADIATOR HANGERS.

Gloeckle, Jr., A. F., Rochester, N. Y.
Hartman Co., Chas., Brooklyn, N. Y.
Healy-Ruff Co., Minneapolis, Minn.

RADIATORS, STEAM AND WATER.

American Radiator Co., Chicago, Ill.
Gurney Heater Mfg. Co., Boston, Mass.
International Heater Co., Utica, N. Y.
Simmons Co., John, New York.

RECEIVERS.

Air.

American District Steam Co., No. Tonawanda, N. Y.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.

Advance Pump & Compressor Co., Battle Creek. Mich.
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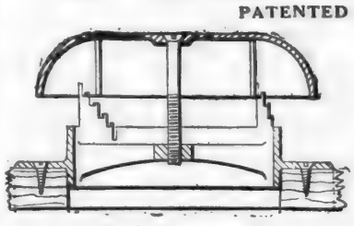

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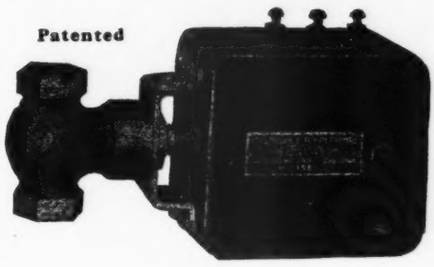

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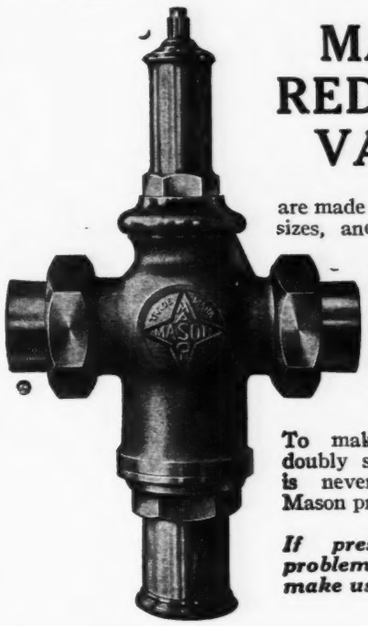

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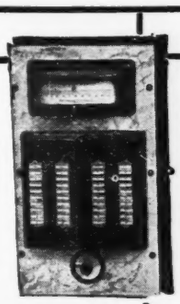

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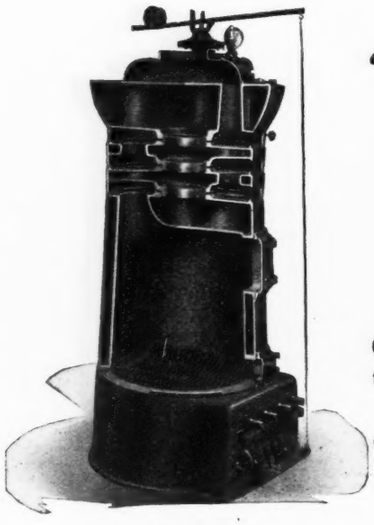

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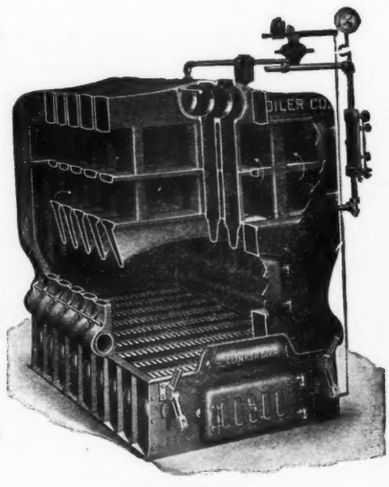

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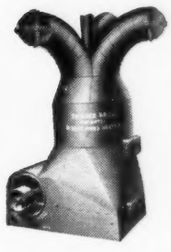

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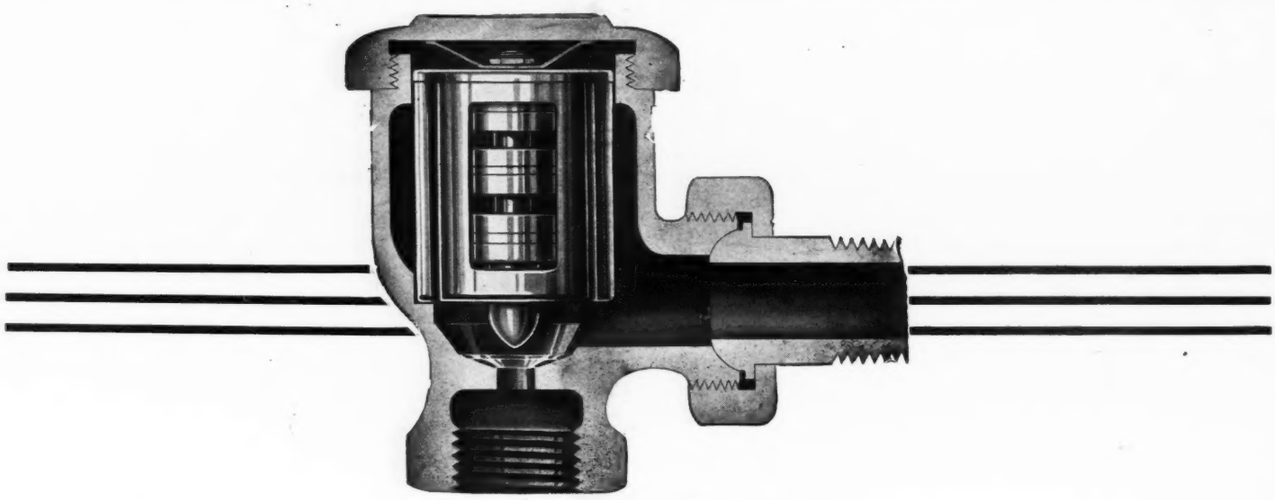

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